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Engineers and the Supply Business

THE discussion of the respective qualifications of technical and non-technical men is not losing interest as efforts proceed to put the electricity supply house in order. The problem has assumed new aspects from time to time as undertakings have grown from very small affairs whose operations were always associated with the names of pioneering engineers, to the large systems which are becoming great industrial organisations for the control and prosperous development of which engineers and managers and a body of specialised officials are working together in systematic pursuance of a well-thought-out policy.

In the modern system duties have to be allocated to a number of men who have specialised in one part or other of the activities—call them technical and commercial for the sake of using comprehensive terms—essential to efficient working, reasonable revenue, and low charges. Under efficient working there fall, of course, both the smooth running of the equipment and satisfactory relations beween all sections of the personnel.

In the past this subject has not been discussed without bias, certain condescension and warmth of feeling. The new nature of the problem in these days, however, suggests that we should abandon such an attitude and approach the matter with a common desire to secure the system of organisation which shall produce the best results all round. Airs of superiority and detachment will not avail as substitutes for ability in administration and commercial development.

Much has been written regarding the absorption of engineers with technical matters and their lack of commercial, financial and industrial training and experience; and much has been said of the inability of some commercial men to grasp the peculiar significance of points of supreme technical importance, so we need only mention these points in passing. But such thoughts will be in our readers' minds as they examine the case which is put before them in the article on "Engineers and Business Matters," by Mr. R. H. Rawll, on page 86.

The author, himself an engineer connected with one of our greatest electricity supply systems in a manufacturing centre, is fully alive to the shortcomings and disinclinations of some technical men, due to their theoretical and practical engineering training making heavy demands upon their time during the most important years of their lives. He ventures to make a number of suggestions regarding ways in which they may gain freedom from too close and exclusive a technical atmosphere and cultivate a closer acquaintance with "the other side" and those responsible for it.

In some places this course may not prove to be so clear for such fraternal exchange of knowledge and experience, but the matter is certainly one worthy of discussion, and we believe that an up-to-date exchange of views, taking Mr. Rawll's article as a basis, would be useful.

The need for the electricity supply industry to be conducted everywhere on enterprising and spirited lines is more pressing than is the anxiety lest entrenched ideas should be exploded.

Penny Foolish

THE illuminations at Blackpool have brought so much profit, direct and indirect, to the town that it is exceedingly disappointing to learn of an attempt to get a "cheap" man to replace Mr. C. Furness on his retirement as borough electrical engineer and manager. The reason given is the old one that not so much electricity is being generated now—evidence of the confusion between "engineers" and "engines" in the minds of too many municipal councillors. The general supervision of the specialist engineers who operate a power-station is, of course, only one aspect of the duties of a chief electrical engineer. Apart from the responsibilities of adapting and extending a distribution network, which are becoming much greater than ever they were, a first-class man is needed to make the most of his bulk supply. The requisite combination of technical and organising ability is not too common, and will have to be paid

for adequately if electrical development is to be as rapid as it ought to be. Few things are likely to hinder progress more than a niggardly attitude towards the remuneration of the staffs of supply undertakings.

Manchester Leads the Way

IF the example just set by the Manchester Electricity Committee is followed by electricity supply undertakings generally we may look forward to substantial additions to the funds of the Electrical Industries Benevolent Association. The local area committee has lately been issuing appeals for financial help and for the co-operation of those in a position to influence the minds of others. Mr. W. Walker, of the Central Electricity Board, and Mr. H. C. Lamb, the city electrical engineer, are on the committee, as is also the honorary secretary, Mr. L. E. Wilson, who has been showing marked activity. Whatever other results have followed the appeal, the outstanding achievement is the decision of the Manchester Electricity Committee to subscribe £100 and to appoint Ald. R. W. Shepherd a governor of the Benevolent Association. Our gratitude to Manchester for leading the way and our congratulations to the area committee! To use arguments to stress the importance of the decision were superfluous; but we think we can see many an electricity supply chief, committee-man, and director putting on his thinking cap and asking his associates what they are going to do about it. E.I.B.A. helps past employés of electricity undertakings, so contributions from the latter are surely, nowadays, an obligation.

Two Thousand Million More

ALTHOUGH the tendency for manufacturers to change over from private plant to public supply must be taken into account, the increase of more than two thousand million kWh in the output of authorised undertakings during 1935 obviously reflects a great advance in the use of electricity during the year. Other influences have been at work in the opposite direction, notably, the more efficient utilisation of electrical energy by reason of improvements in the design of plant and apparatus, the introduction of motor vehicle services in place of trams, etc. It is, perhaps, rather surprising that the summer "valley" in the generation curve is as pronounced as ever, in view of the low tariffs which are available during the warmer months. We do know, however, that there has been a large increase in the use of electric water heaters and other apparatus often regarded as merely a summer load, and the inference is that the users are so satisfied that even during the cold months, when they may be expected to revert to coal fires, they prefer the easier, labour-saving electrical way.

Anæsthetic Explosions

THE Ministry of Health has been investigating the risks attaching to the use of ether-oxygen mixtures as anæsthetics, and has commendably drawn attention to the precautions that should be adopted before serious accidents have drawn public attention to the subject. In the preparation of its Circular 1512 (Stationery Office, 1d.) it has received the assistance of the Factory Department of the Home Office, of which Mr. H. W. Swann is the electrical authority. Ether-oxygen vapour may ignite at 350 deg. C. below the visible red heat of a metal, and a very small spark may cause a violent explosion. This rules out its use in connection with surgical diathermy, in which an electric arc is employed for cutting tissue. The construction of X-ray apparatus calls for especial consideration to avoid sparking due to defective connections or insulation. For surgical lamps the risk is much less when small dry cells are used with 2.5 to 3.5-V lamps, and direct connection with the mains through a regulating resistance is evidently regarded as inadvisable. Even air conditioning may have its dangers, due to the possibility of static discharge in a warm, dry atmosphere. Adequate ventilation, however, is an important factor in reducing the chances of explosion in all cases.

The Gale

COMPARED with the tale of fatalities, floods, founderings at sea, dislocation of traffic by land and air, and destruction of property, the effect of last week's gale on electricity supply seems to have been singularly small. A gale which reached in some places 100 m.p.h., or only 11 m.p.h. less than the highest recorded, provided a good test of our methods of overhead-line construction. Information so far available shows that the higher-voltage lines suffered least; the only failure of grid supply reported was for a minute or two at Harrogate. Débris blown across the conductors, no less than structural breakdown, was responsible for some failures. The district that suffered most appears to have been North Wales, where conditions were especially severe, and the hilly nature of the country calls for the use of long spans; newspaper reports indicate that interruptions in supply occurred due to phase conductors swinging out of synchronism.

Electric Steam Raising

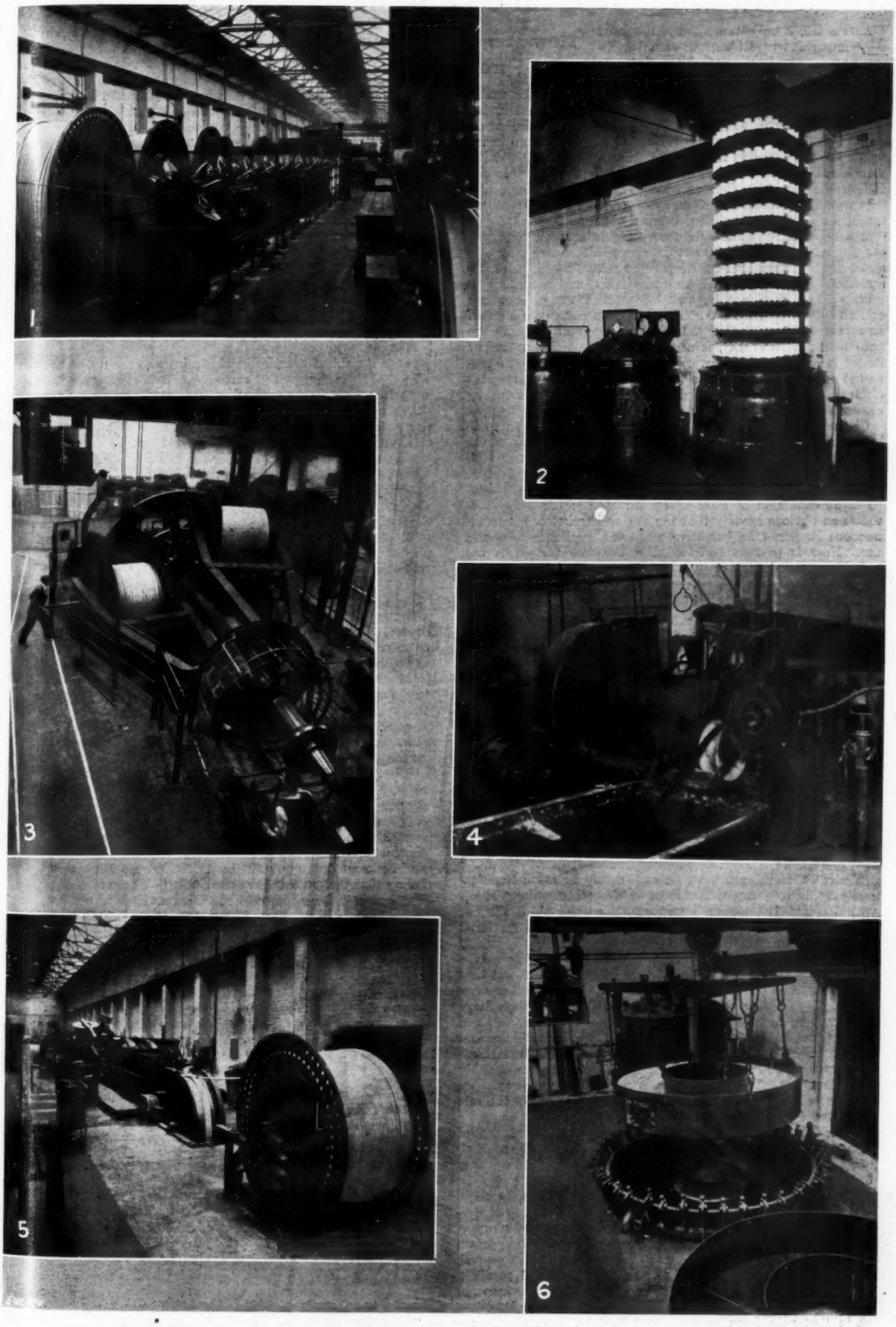
THE production by electricity of steam for industrial processes provides a useful off-peak load in water-power countries. In Canada, according to the *Electrical News*, over 1,500,000 kW of electrode boilers are in use in 163 plants, chiefly employed in paper manufacture. The largest of these has a capacity of 147,000 kW in four units, of which three are loaded at 42,000 kW. The 35,000-kW installation described in this issue, which is said to be the largest in Norway, brings in an annual income of £25,000 to the undertaking. This is one of the instances (not so many as is often supposed) in which fuel-fired generating stations cannot compete with hydro-electric stations. To compare with local steam raising by coal of 11,500 B.th.u. per lb. at 16s. per ton, the price of electricity should not be more than 0.03d. per kWh, whereas the best of our base-load stations requires just about a pound of coal to generate a kWh, and the cost, without distribution losses, is nearly three times that figure.

Prevention Better than Cure

BOTH papers read at the I.E.E. Transmission Section meeting on Wednesday made a good case for the testing of high-voltage cables before deterioration likely to cause breakdown has set in. Mr. A. N. Arman and Mr. T. A. Starr demonstrated the need to detect ionisation before its effect on power factor becomes appreciable, and Mr. C. Kibblewhite advocated the application of d.c. at five times the working (a.c.) voltage for locating weaknesses that might later result in failure of insulation. In his presidential address two sessions ago Mr. P. V. Hunter suggested that the dielectric of an 11-kV cable could be reduced so as to give the same working stresses as those permissible at 66 kV. It cannot, however, be taken for granted that old cables with thicker insulation which are in use at lower voltages can be rated up to 11 kV, for, as Mr. Kibblewhite stated, the present standards have become practicable owing to recent developments in design. There is apparently economic justification for the test methods proposed, but, more important still, is their probable effect on reliability of supply.

What is a Factory?

THIS question is prompted by the case reported on page 96 of this issue. A man working on a scaffolding during the construction of a cinema received a fatal shock due to a defective and unearthed lamp-holder. His employers were summoned for a breach of the Electrical Regulations under the Factory and Workshops Act, and, although their solicitor maintained that as nothing was being manufactured on the premises and there was no working machinery there, the Act did not apply, his submission was overruled and the firm was found guilty and fined.



The Charlton Works of Messrs. Johnson & Phillips, Ltd. **(See page 81)**

1. High-speed paper lapping machines. 2. Static condenser elements about to enter a vacuum impregnating chamber. 3. Large laying-up machine for e.h.p. cables. 4. Forcing (extrusion) machine for t.r.s. cables. 5. Laying-up and paper lapping machine for cable up to 11 kV. 6. Vacuum chamber for e.h.p. cables.

Current-using Appliances. By H. R. Taunton, A.M.I.E.E.

New requirements and prohibitions

LAMPS are, if only numerically, the most important of all current-using appliances; and the compilers of the I.E.E. Wiring Rules evidently felt they must make some rule about them in Section 7 of the tenth edition, devoted to the "installing" of such appliances. It is difficult, however, to clothe with any majesty of technical or legal phraseology the simple operation of putting a lamp in its holder; so they had to content themselves, in Rule 701, with a reference to the "design and construction" of lamps, the subject matter of another section. The rule, therefore, like that which follows it, and so many others on the same lines in this and the preceding section, is merely space-wasting.

It will be seen in Rule 703A that portable heating and cooking appliances need not be switch-controlled. No reference is made here—though it is in the parallel rule, 713—to Rules 208 and 209; but these are the pertinent rules, and according to them sockets need not be switch-controlled unless they are d.c. and of more than 5 A. This has been commented on in an earlier article. The suggestion of an indicator lamp, in the note to this rule (703A), is a sound one. Indeed, if "safety first" is to be our watchword, it might well have been promoted from a suggestion to a rule. One of the commonest electrical mishaps is fire caused by an electric iron left standing connected on a wooden table.

Clause B of the rule allows even fixed heating appliances to be installed without individual switches if, as is often the case, they are connected to a socket (complying with Rules 208 and 209). This is surely a step backwards. The old rule, 124B, called for local switching in all cases. There really seems to be some confusion of thought on this point; for Rule 703D shows an obvious anxiety that the flex and socket of such connections shall not be left alive when the appliance is not in use. How is that to be avoided if the socket itself is not switch-controlled? It need not be, as the rules stand. ("Switch-controlled" here means controlled by an individual and local switch, or, as the Rules prefer to word it, by "a switch in the final sub-circuit"—which, unless qualified, might mean a switch on an inaccessible dis-board.)

The rules (Clauses B and C) alluding to thermostatic control are, of course, new. Does Clause C (limiting thermostatically controlled loads to 5 kW) apply to water-heaters, which are usually so controlled? Presumably it does; but if so, it would seem to conflict with the terms of Rule 714C.

Rotating Machinery

Rules 704 and 705, dealing with the installation and control of motors and other "rotary electrical machines" follow, with slight variations of wording and arrangement, Rules 117 to 119 in the last edition. Rule 706A is new, and allows circuit-breakers and fuses to be adjusted to carry the starting current of motors in excess of the nominal capacity of the cables serving them. The following clause (B) is merely a second repetition of Rule 4F amended.

The rules referring to resistances (707,708) now do not necessarily apply to those of less than 60 W rating. These rules, with 709 and 710, are an improvement on the ninth edition, inasmuch as they bring together and compress its scattered rules for resistances, chokes, transformers, &c.

The three clauses of Rule 711 are in their essentials only a repetition of the corresponding clauses of Rule 414, except that the one applies to the apparatus of bell and signalling systems and the other to their wiring. All might easily have been covered by a single rule if, as before suggested, bell and similar installations were dealt with in a separate section. Clause A of Rule 712 stipulates that the cores of bell transformers shall be earthed, and refers to Section 10, presumably to Rule 1001F. What about the core of the popular bakelite pattern? Practically, of course, it doesn't matter; but the rule makes no exception for them.

Rules 714 and 715 are wholly new. The interpretation of clause B of the latter is not easy. According to it, the shell of an electric boiler must not only be earthed in the usual way but must also be connected to the neutral of the supply. In other words, the neutral is to be earthed at the boiler shell. But a note to Clause C (see also that at the beginning of Section 9) draws attention to the fact that the neutral of a supply may only be earthed at more than one point with the approval of the Electricity Commissioners. Without that approval, what becomes of Rule 715B? Clause D of Rule 716 parallels, for appliances, the similarly worded rule (618C) for accessories in garages. The height at which appliances may be fixed has, as in that rule, been reduced to 4 ft. 6 in. from the former 6 ft.

Electric Signs

In the ninth edition electric signs were dismissed in a single rule, 116. It is evidence of the rapid growth in popularity of these typical products of "modernity," ripping the night sky with restless flares, that the single rule has now expanded to a whole section of six and a half pages. To be sure, all but the first rule in it are concerned with neon and similar signs, which were not mentioned at all in the last edition. Rule 801F should be compared with Rule 201D. In the latter a limit of 10 amps is imposed on any final sub-circuit feeding a lamp sign. In the former, however, no such limit is mentioned, although it is otherwise much to the same effect.

The remaining rules, as remarked above, deal with "luminous-discharge-tube installations." Sign work of this kind is now almost entirely in the hands of specialists, and the ordinary contractor, even if the order passes through his hands, has nothing to do with it beyond the supply and erection of the primary wiring from the mains to the sign transformers. Even the "safety switch" (see Rule 807), and sometimes the fireman's switch, is now supplied by the sign makers as part of their equipment, and he is left with only the fixing of them.

The only rules, therefore, which interest him directly are 805 and 806, dealing with primary final sub-circuits; 807, dealing with the safety switch—but see above; and 808, dealing with the fireman's switch, and wisely emphasising the necessity of collaboration with the local fire brigade. The other rules, 802 to 805 and 809 to 815, are concerned with the sign itself, its transformers and secondary wiring, and are for the sign makers to observe. It is rather quaint, by the way, to read in the original Rule 810B that "in no circumstances" shall secondary wiring be run in metal conduit, in view of the amendment, nine months later, allowing it to be protected in "short unjointed lengths of metal pipe." However, it is pleasant to know that our mentors are not deterred from correction by an earlier dogmatism.

Radio Equipment

Section 9 of the Rules, covering radio apparatus, is, of course, an entirely new one: the word "radio" is not so much as mentioned in the last edition. Even less than the preceding section, this has no application for the ordinary contractor. He may occasionally be called upon to install the loud speaker wiring for some institution, and, more commonly, the main circuit supplying the apparatus, in which case he may read Rules 902 and 903. All the others, dealing for the most part with the actual construction of radio equipment, are no concern of his.

Whether all the highly polished cabinets of all the many makers who specialise in wireless receivers for mains connection enshrine all these rules in virtuous exactitude, or are only whited sepulchres of infringement, is one of the mysteries they hide. Presumably a contractor responsible for the installation of one of them is also responsible, if he has undertaken to comply with the I.E.E. Wiring Regulations, for seeing that the makers have observed their part of them. Unless, however, he is himself a radio expert, it is impossible, and in any case difficult, for him to decide whether any particular set complies with the requirements of Section 9. We may assume that the leading makers, at least, accept them and abide by them. It should be a simple matter for them, then, to give a guarantee to that effect with every mains set, which might take the form of a suitably engraved label attached to it. That would soothe the qualms of the conscientious contractor, who must otherwise ignore a whole section of the Rules to which he is anxious to give due allegiance.

I.E.E. Meetings

The arrangements for the second half of the 1935-36 session of the Institution of Electrical Engineers include the following meetings in London:—January 30th: "Micro-Ray Communication," by Messrs. W. L. McPherson, B.Sc. (Eng.), and E. H. Ullrich, M.A. February 20th: "The Development of the Single-Break Oil Circuit Breaker for Metalclad Switchgear," by Messrs. D. R. Davies and C. H. Flurscheim, B.A. March 5th: "The High-Pressure Mercury-Vapour Lamp in Public Lighting," by Mr. G. H. Wilson, B.Sc. (Eng.), Lt.-Commdr. E. L. Damant, and Mr. J. M. Waldram, B.Sc. (Eng.), March 19th: "Cineradiography", by Mr. R. J. Reynolds, C.B.E., M.B. April 2nd: "Tariffs for Domestic and Business Premises," by Mr. B. Handley, and "The Prices for Electricity Supply," by Prof. Miles Walker, M.A., D.Sc., F.R.S. April 23rd: The twenty-seventh Kelvin Lecture, "The Transmutation of Matter by High-Energy Particles and Radiations," by Mr. J. D. Cockcroft, B.A., M.Sc.Tech. May 7th: Annual general meeting, Faraday Lecture on "Television—An Outline," by Mr. E. Mallett, D.Sc. (Eng.). The annual dinner will be held on February 13th at Grosvenor House, Park Lane, W.1.

Activities at Charlton

What the J. & P. works are doing

LAST week in referring to the diamond jubilee of Messrs. Johnson & Phillips, Ltd., we commented on the facility with which the firm has adapted itself to meet changing conditions. Indeed, to the electrical public, the preceding sixty years of the company are significant mainly on account of their influence on its position to-day, since these years provided an opportunity for building up a tradition of sound design and conscientious workmanship upon which its present practice is based. That a world-wide reputation created over a long period is a valuable asset is illustrated by the large number of orders now being executed for overseas as well as home markets, but the present activity in the shops owes even more to the fresh ideas that are being applied to meet, or to anticipate, new trends in the distribution of electricity.

Section of the laboratory for testing cable materials

Apart from the number of new or modified designs in the large variety of apparatus made by the company, what impressed us most during a recent visit to Charlton was the evidence provided of readiness to adopt improved machinery as soon as a change is justifiable and of the ingenious way in which new plant is incorporated in the general scheme without holding up the work in progress.

The Cable Department

The cable works is especially notable in this respect. Until comparatively recently the stranding and insulation of conductors differed in no important respect from the technique of rope making, which goes back many centuries. The use of shaped conductors (with their apices towards the centre of the cable), for reducing overall dimensions, led to difficulties, especially at higher voltages, due to the creasing or bursting of the papers. Such conductors for J. & P. cables are therefore laid-up pre-twisted, flexibility being gained by employing a special arrangement of the wires forming the conductor.

One new high-speed machine capable of stranding a very large number of wires simultaneously, represents a notable recent addition to the large family of the familiar cable plant. It is not always realised that the load factor of this elaborate machinery is extremely low, as the running time is often not much more than a tenth of that required for making ready.

The engineers appeared to be particularly pleased with the performance of the recently installed super-voltage vacuum impregnating plant, so much so that extensions are in hand which will much increase the capacity of the existing installation. In this vacuum equipment super-voltage cables are dried and impregnated under accurate control at all stages of the treatment—special attention being given to the process during the cooling-down period. It was noted that the vacuum obtainable was of an extraordinarily high order. Tray impregnation is employed in which the cable is continuously immersed in insulating compound. A special arrangement is employed to ensure complete circulation of compound to the trays of cable, and from the commencement of impregnation until the operation of lead sheathing the cable is not exposed at any time to the atmosphere.

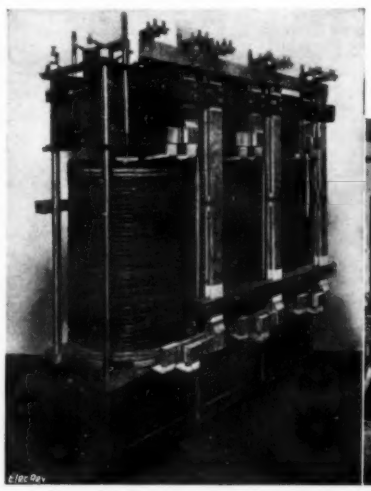
There are two test bays for paper-insulated cable, one for cables up to 11 kV, the other for cables above 11 kV and up to 66 kV. Five transformers stepping-up the supply from the South Metropolitan Co. to various pressures up to 100 kV are included in the equipment in the first case, and warning lamps are automatically illuminated as soon as the test areas are made alive. Plug boards are installed for connecting the various testing areas to the instruments in the laboratory. A departure from old practice is noticeable in the absence of water immersion testing tanks (the old ones have been filled in). Cable is not allowed to come into contact with water at any stage of manufacture or testing. Experience has shown that a defect in the sheathing is likely not to be shown up at the time, but any water absorbed may cause a fault to develop later when the cable has been put into service.

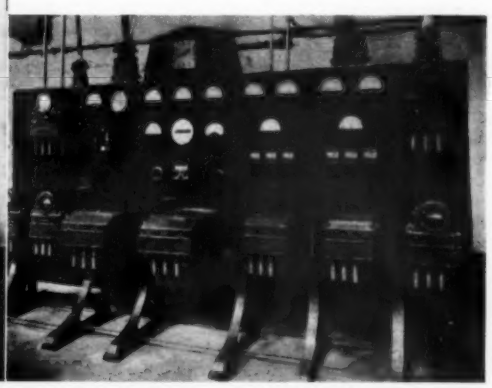
For testing e.h.p. cables and for research 100 kV, 250 kV and artificial loading test transformers are installed. There is also a 0.0001 μF air-dielectric standard condenser insulated for 100 kV used in conjunction with a Schering bridge for p.f. measurements up to 100 kV. Almost all the test gear used is of Messrs. Johnson & Phillips's own manufacture.

One of the responsibilities of the testing department is the production of jointing materials and the training of jointers in their use. All jointers are put through a practical examination before being permitted to work on contracts; this applies also to men promoted from low- to high-voltage jointing.

The chemical laboratories, which have been more than doubled in size during the last two years, are equipped for investigations into and check testing of the characteristics of compounds, paper, rubber and all raw materials. Apparatus is also installed for conducting accelerated ageing tests on rubber insulated cables, so as to be able to pre-determine their performance in service. Two years' natural ageing in the tropics can be reproduced in the laboratory in a few days.

The rubber cable works—one of the oldest of the company's enterprises—shows the same tendency to keep abreast of the times as was noticeable in the paper cable works. Among recent improvements may be mentioned the vulcanising equipment, which is the most modern of its type. It is automatically controlled both as regards times and temperatures. Large capacity mixing rolls and forcing machines of new design are among further additions to the plant. The braiding shop was particularly impressive; it has been rebuilt recently and equipped with entirely new high-speed plant of the latest pattern. The testing section of the rubber-cable works has been entirely reorganised during the last two years and the test rooms themselves have been rebuilt and re-equipped.

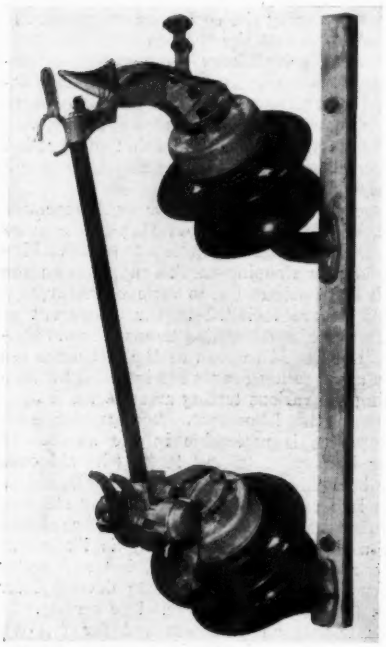




Left: A typical J. & P. transformer. Right: 11,000-V industrial type switchgear

Transformer Manufacture

In the transformer department a variety of examples of from 1 to 7,500 kVA units were under construction, half of which were for export. An interesting example was the 5,000-kVA delta/star transformer as a spare for grid sub-stations, stepping down from 33 kV to 11, 6.6, 3.6, and 3.3 kV with on-load 33-kV tap-changing covering a range of ±10½ per cent. which gives, we believe, the greatest number of alternative voltages yet provided. For mining conditions a five-limb type of transformer was on view which saves half the yoke height and solves the limited head room problem.



33,000-V, type "D" drop-out switch-fuse

The approach of a public television service is symbolised by the d.c./a.c. chokes that have been built (together with other apparatus) for the first station at the Alexandra Palace, while the large number of pole-mounting transformers awaiting despatch reflect the move towards electrification of rural areas, including those served by J. & P. subsidiaries.

In winding the transformers paper insulation is used throughout, but additional strength is imparted to the dielectric of the end turns by reinforcing them with varnished cambric tape. The continuous-disc winding is preferred for medium currents, and any joints are electrically welded.

Switchgear and Instruments

We were reminded again of the attention now being paid to rural distribution in the switchgear department by the "E.K.C." automatic reclosing oil circuit-breaker (which operates up to three times for adjustable periods before locking out). In ninety-seven times out of 100, we were informed, a line can be switched in immediately without the circuit-breaker opening again. An ingenious method of clamping high rupturing capacity cartridge fuses to bakelite bars, so making a true switch-fuse, was shown us as providing an inexpensive method of mounting that allows for ready replacement. Fuses of the "D" type are a new design for outdoor service at 11 and 33 kV which will successfully break 100,000 kVA. On the blowing of the fuse, the holder is released and drops, enabling the faulty circuit to be promptly recognised and attended to.

In the manufacture of circuit-breaker tanks, fabricated steel plates have superseded castings for the production of inexpensive but robust apparatus. A new design of the truck-type unit with vertical drop-down isolators was shown us, for which the demand was said to be heavy, as also for the familiar high-voltage and low-voltage circuit-breakers with circular or rectangular tanks and switchboards, some of the dead-front type.

Practically all the electrical measuring instruments used on J. & P. switchgear are made in the company's instrument department. Government contracts for radio work are always in hand, while the department's contribution to the needs of radio relay engineers represents still another instance of the company's continuous expansion when opportunity allows.

Power Factor Improvement

The growing tendency of supply undertakings to take account of power factor in framing their tariffs is being met by the production of oil-immersed static condensers made in conformity with the patents of Messrs. Haefely, and of from one-third kVAr low voltage up to over 500 kVAr for voltages up to 33 kV. There is a demand for these units from abroad, as was shown by a batch of forty-four 35-kVAr units intended for China. The impregnating plant used in the manufacture of these condensers is a miniature version of that used for the impregnation of e.h.p. cables previously described.

Water-heater Production

In the water-heater department heaters of from 1½ to 30-gal. capacity are being manufactured. Many types are made in both rectangular and cylindrical shapes. The greatest call is for the smaller sizes, but a steady demand is experienced for heaters of larger capacity, notably for the 5- and 12 gal. sizes, and there is a definite market for heaters of the cistern type. The ceiling cistern pattern represents a successful attempt to deal with situations where space is a most important consideration.

All joints in the body of the tanks are welded—not soft soldered—and hydraulically tested before and after immersion in molten tin. The method of building up the element of interlocked special fireclay formers on a nickel-chrome central rod makes replacements an easy matter.

The finish seemed to us to be especially good. Every part of the outer casing is painted separately, both inside and out, with a synthetic enamel. Two coats of finishing are applied and each is separately stoved, the final coat leaving the body with a high gloss which is permanent, and not easily marked or chipped.

The Contact Department

While we are unable to do more than describe briefly the many diverse activities of Johnson and Phillips, there is one important department that was not totally "on view" during our visit to Charlton—the contract department, whose engineers have been responsible for the erection of many sections of the national grid and hundreds of miles of overhead lines for linking up outlying areas. The department also supplies overhead line material to undertakings which erect their own lines.

A subsidiary of the company (British Permel Enamelled Wire, Ltd.) carries out the manufacture of fine enamel wires for scientific, domestic, radio and automobile appliances by what we were informed was the most recent plant in Great Britain. In the new wire-drawing plant, copper wire is drawn to any gauge required down to No. 47 s.w.g.—finer than a human hair. Special machines polish the diamond dies used in this operation, and the even quality of the wire drawn is gauged within 0.00005 in. by a sensitive optometer. It is claimed for the process that the stretching or tying into knots of the wire does not impair the insulating properties of the enamel.

The lacquered wire is subjected to continuous voltage tests throughout the process, in which each reel has its own electrically heated oven. The final tests for pin-holes are carried out on an automatic fault-registering machine, the requirements of B.S.S. 156 being surpassed with ease. In a breakdown test, we observed that the insulation of a wire of 34 s.w.g. failed at 5,000 V, the B.S.S. minimum value being 300 V. Cleanliness being essential to enamelling, air entering the department is water-spray conditioned, and fumes from the lacquer are sucked into pipes which convey them to a 45-kV electrostatic precipitator.

Our thanks are due to Mr. H. J. Sheppard, managing director of Messrs. Johnson and Phillips, Ltd., and his staff, for affording us facilities on the occasion of our visit to the Charlton works.

I.E.E. Western Centre Dinner

THE annual dinner and dance of the Western Centre of the Institution of Electrical Engineers was held at the Royal Hotel, Cardiff, on January 13th, Mr. H. Manley Roberts presiding. Among the guests was the Lord Mayor of Cardiff (Ald. G. F. Evans, J.P.), who proposed the toast of the Institution. The President (Mr. J. M. Kennedy, O.B.E.), responding, said that in 1935 the output for the whole country was about 14 per cent. more than in 1934, and in December, 1935, over 24 per cent. increase was recorded over the corresponding month of 1934. It was the aim of the Institution and its members to flatten out the peak loads during cold and dark days, and they should do their utmost to ensure similar outputs during summer days by increasing the field of consumption. The object of the Institution was to make electricity available to all, and to discover means of supplying it to all classes. The chairman, Mr. H. Manley Roberts, then made a presentation of a silver coffee set to Mr. C. G. Morley New, and paid tribute to his work in Cardiff as the city electrical engineer. Mr. Morley New briefly responded.

Mr. J. W. Spark proposed "Our Guests and Kindred Societies," and in coupling with the toast the name of Mr. John Kane (president of the South Wales Institute of Engineers) referred to the willingness with which the Institute lent its room for the Centre's meetings. Mr. John Kane responded. Mr. W. Roberts proposed the toast of "Our Chairman," and Mr. H. Manley Roberts replied.

Instrument Design Progress.

By G. F. Shotter, A.M.I.E.E.

Developments in electro-physics

THE Physical Society's Exhibition this year gave every indication that its already wide popularity is rapidly increasing. It is not only of great scientific and engineering interest, but it has an important social aspect. Many people who would otherwise be unable to meet can gather at least once a year at the Exhibition to discuss their common interests. The apparatus shown is so varied and is becoming so specialised that the task of reviewing the exhibits is becoming increasingly difficult each year. The reviewer can only convey a general idea of the advancement made since last year and mention some examples of the better-known apparatus of improved or novel design, and also refer to such items in the Research Section which may lead to practical developments in the future.

Cathode-ray Oscillograph Development

General improvements in cathode-ray and associated apparatus were apparent. The uses of this instrument are being further extended, and one of the most interesting applications of this device shown is its use as an engine indicator in which the cathode-ray oscillograph acts as the recorder. The field of application in this direction would appear to be extremely wide, covering all types of engines, valve movements, pressure indicator diagrams, &c., for not only can the instrument be applied to stationary engines, but also to road vehicles, locomotives and even aeroplanes in flight. The equipments of this type shown by Messrs. Cossor and the Standard Telephone Co. both attracted a considerable amount of attention.

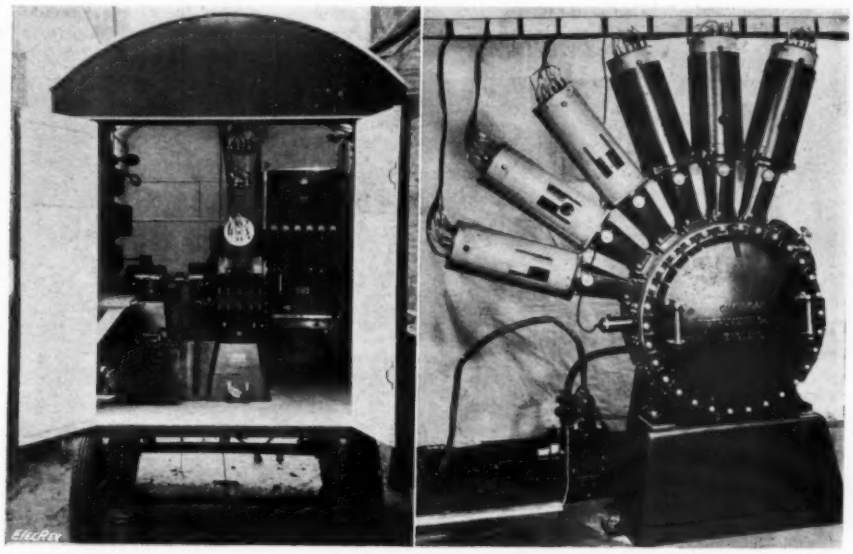
An outstanding development in the practical use of the cathode-ray oscillograph is the portable multi-element oscillograph built primarily for the field investigation of transients in electricity supply networks. This unit was built for the Electrical Research Association by the Cambridge Instrument Co. and consists in essence of a cast-bronze housing, the oscillograph and the recording elements being mounted radially round this housing. Each element is staggered laterally across the drum so that each records a different zero.

The oscillograph elements consist of the high-vacuum, high-definition sealed-off type of heavy-duty television transmitter tube. Provision is made to accommodate twelve cathode-ray units, but only six are at present fitted. The complete assembly in a van includes the control gear and arrangements for camera loading and film development.

A salinity tester for bacon and cured meats (Eversheds & Vignoles)

The demountable cathode-ray tube, termed an "electron optical bench," shown by the General Electric Co. is provided with a vacuum-tight ground-glass joint at the end of the neck, the detachable portion carrying a twelve-pin cap for making connection to twelve sliding contacts within the tube. This apparatus has been developed to facilitate the design of high-vacuum cathode-ray tubes used in television.

Mention should also be made of the Ediswan Co.'s high-vacuum tube with a fluorescent screen giving a substantial black-and-white picture. Messrs. R. Hanbury Brown & P. J. Tyler also demonstrated an interesting new application of the cathode-ray oscillograph to the projection of lamp polar curves.



A transportable Cambridge cathode-ray oscillograph made for the E.R.A.

The Cambridge Instrument Co. exhibited a Duddell oscillograph incorporating three vibrating elements in which the sensitivity has been increased ten times by the use of a new magnetic system of AL-NI steel. The sensitivity obtained for 60 mA is 20 cm. deflection with a resonant frequency in air of 3,000 cycles. The gain in sensitivity should increase the value of this kind of instrument and is an example of the advantages of the use of this new type of steel.

While on the subject of new magnetic materials reference should be made to the Everett Edgecumbe recorders, in which oil damping has been replaced by magnetic damping employing these materials. Another magnetic alloy was shown by Messrs. Darwins, Ltd., *i.e.*, the "D.C.I." magnetic alloy, which in fields from 50 to 150 c.g.s. units the intensities of magnetisation are approximately 30 per cent. greater than those of pure iron melted *in vacuo*. It is intended for incorporation in magnetic circuits required to produce very high flux densities across narrow air gaps.

Portable Noise Meters

Greater prominence is now being given to the measurement of noise levels, and at least four firms exhibited instruments for this purpose. The Metropolitan-Vickers' instrument uses the principle of aural comparison of the complex noise under observation with a pure reference tone of fixed frequency and adjustable amplitude. The Standard Telephone Co.'s instrument is of similar design, but uses a multi-frequency reference tone and, in addition, measurements can be made either by the marking method, using a set-off earpiece, or by the equality method.

A third instrument, shown by the Western Electric Co., in addition to using the subjective method as in the previous instruments, allows the measurement of noise to be obtained by the objective method employing a microphone, amplifier and indicating meter, the last two being given certain characteristics to simulate the performance of the ear. Another design of noise meter was shown by Messrs. E. K. Cole. There can be no doubt that such instruments as these will prove of considerable assistance to those familiar with the problems involved in the difficult subject of the measurement of noise.

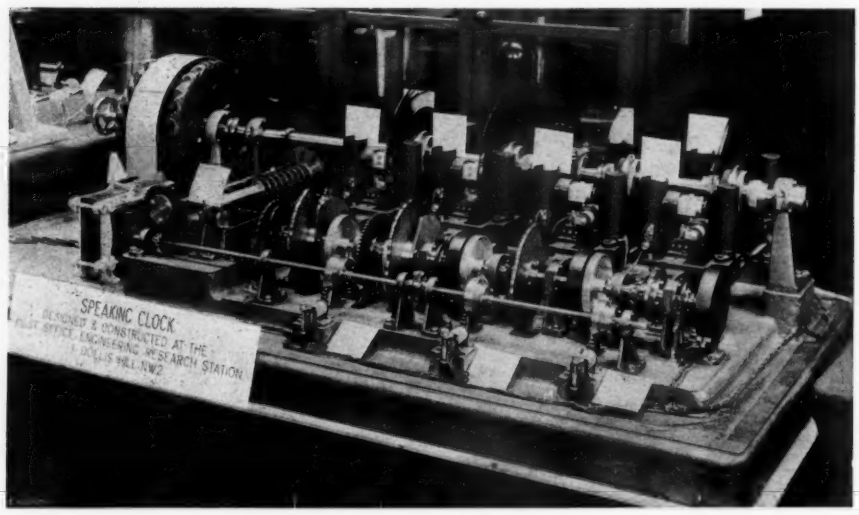
Photometers and Photo Cells

Although there are no outstanding developments, there is every indication that the photo-electric cell is being put to wider use. An important advancement is the extension of the range of the street-lighting photometer, which now enables values as low as 0.01 foot-candle to be measured. The Everett,

Edgecumbe photometer should be of great utility as it gives on its lowest range a full-scale deflection for 0.3 foot-candle and, moreover, gives compensation for light sources of different colour. Instruments of similar pattern are shown by the Salford Instrument Co. (full-scale deflection on its lowest range for 0.3 foot-candle) and by the Weston Instrument Co. (full-scale deflection on its lowest range for 1 foot-candle), correction factors being given for different coloured light sources.

The practical advancement brought about by the use of the self-generating cell is a boon to those who were formerly compelled to use what was familiarly known as the "out damned spot" type of photometer!

A useful addition to this class of instrument is the Everett, Edgecumbe "cube" integrating photometer, in which arrangements are made for compensating for internal obscuration by the lamp or fitting under test. Messrs. Hilger show another interesting application of the self-generating cell, in which two cells are connected in opposition and used to amplify the deflection of a galvanometer mirror several hundred times.



The G.P.O. "speaking clock" mechanism

Telemetering

A novel development in connection with the indication at a distance of the level of water or other quantities is the "Telemeter" system of Evershed & Vignoles, in which a very ingenious arrangement of single-wave rectifiers is used, two being situated at the transmitting end and two at the receiving end. Alternating current is supplied at the transmitting end to the centre tapping of a three-terminal potentiometer, the ends of which are connected to two single-wave rectifiers in opposition, the opposite ends of the latter being commoned on to one of the pilots. At the receiving end the current is again split on to two single-wave rectifiers, the ends of which are connected to a moving-coil ratiometer. This arrangement produces an alternating current in the pilot, in which the zero point moves as a function of the position of the centre tapping of the potentiometer, thus necessitating only two pilot wires.

A further development of interest in telemetering is that for the transmission of integration and maximum demand, namely, the Elliott-Sangamo transmission system. This method incorporates the Elliott transmission system applied to a three-phase integrating instrument in which the impulses are transmitted without the use of contacts. The impulsing unit can have no effect on the accuracy of the meter or on its light-load running. Only two pilot wires are required, and their resistance may be several thousand ohms without affecting the operation of the apparatus in any way. Another Elliott exhibit showed this system applied to the remote transmission of steam pressures.

Evershed & Vignoles exhibited a further advance in the development of their standard earth testers in the form of an instrument specially designed for geophysical survey. For this work the standard instrument becomes unsuitable owing to the correction necessary for potential spikes, to the restriction of the range of depth penetration to about 300 ft., and also to the high-current spike resistances which makes the instrument sluggish. In the new instrument the effect of the potential spike resistances is eliminated, and any possible errors produced by inter-capacity effects within the instrument and generator are avoided by effective screening, the screening system being connected to a fifth spike centralised between the two potential spikes. The instrument has two ranges of 0.03 and 0.30.

Although no new principle has been introduced in the direct-reading fault localiser exhibited by the Cambridge Instrument Co., the usual slide wire is replaced by two dials, one marked from 0 to 95 and the other 0 to 5, and in use the setting of the dial indicates the position of the fault as a percentage of the length of the section under test. This is an improvement which has been long overdue, as under modern road conditions the accurate location of faults is of the utmost importance in saving time and money. The old slide-wire instrument left much to be desired in this direction. The new instrument is also adaptable to the high-voltage localisation of faults in cable networks.

An application of a new principle in the measurement of power factor was shown by Messrs. Elliott Bros. in the form of an instrument of the iron-cored dynamometer pattern operating on a differential ratiometer principle measuring the ratio of the sine to cosine components in the circuit. The scale, which is nearly linear, reads from 0.5 lag to 0.5 lead. It is a direct driven recorder and has a very high torque, namely, 250 grm.-cm. at full load.

An exhibit which attracted considerable attention was the Philips high-pressure water-cooled mercury lamp. Some indication of the extraordinary nature of this lamp can be gauged from the fact that while it is only approximately 1 inch in length, its loading is 600 W and its output is 36,000 lumens. Its brightness is 40,000 c.p. per sq. cm. and the pressure at which it operates is 150 atmospheres. A great improvement in the colour was to be observed over that of the standard electric discharge lamp, and it is interesting to speculate on the future development of this type of lamp.

Before leaving this section of the Exhibition brief reference must be made to the load alarms shown by Messrs. Everett, Edgecumbe, Ferranti, Ltd., and Nalder Bros. & Thompson. Instruments of this pattern should be useful to large consumers paying on a maximum demand scale.

Research Section

One of the outstanding exhibits of interest in the Research Section was the "speaking clock" exhibited by the G.P.O. Engineering and Research Station. What might be termed the transmitting section of the clock with its auxiliary apparatus is designed to announce the time over the telephone at intervals of 10 seconds with an accuracy of 0.1 second.

The improvement of electric discharge tubes of both the hot and cold types is still progressing, as was shown by the G.E.C.'s exhibits illustrating the use of luminescent materials to increase the efficiency of this type of lamp. The B.T.H. Co. also showed various examples of the use of these materials. The use of these fluorescent and luminescent materials would seem to hold out the hope of increased efficiency.

Dr. F. H. Banfield, of the British Food Manufacturers' Research Association, has worked out an unusual application of the "Megger" type of instrument for testing the salt content of bacon, hams and cured meats. An accompanying illustration shows the method, which consists of measuring the electrical conductivity of the salt solution in the meat, applied to a leg of pork.

The demonstration of isothermals round a hot body by means of a modification of the Schlieren method shown for the Electrical Research Association by Messrs. Lethersich and H. G. Taylor should lead to some very interesting results. Another exhibit illustrated a simple method of obtaining humidity up to 100 per cent. at temperatures up to 100 deg. C. and controlling the humidity to a high degree of accuracy. The essential part of this apparatus is the independent heating of the water and the control of its temperature.

In conclusion, I would like to draw attention to the excellent work turned out by the apprentices and learners, particularly as none of them is over twenty-one years of age. They are to be congratulated on maintaining the high traditions of craftsmanship set by the older generation which are in danger of perishing in these days of mass production.

Electric Steam Raising. By S. Anker-Rasmussen

Electrode boilers in a Norwegian paper mill

IT does not yet seem possible, even in Norway, to utilise water power and convey electricity at a price per kW-year that approximates to that of coal at 20 kroner per ton (£=18.159 kroner at par). Therefore, it does not normally pay to heat boilers electrically, since even in favourable cases power costs from 40 to 80 kroner per kW-year. Only power that is available during off-peak periods is cheap enough to compete with fuel-heated plant.

By an agreement signed in September, 1934, the Norekraft (State Waterpower Central) and the Norderhov Kommunale Elektrisitetsverk (municipal plant) contracted to deliver a substantial amount of off-peak power to the Follum Traesliberi (wood pulp) paper mill near Hönefos at a price equivalent to that of coal.

The Norekraft concern, which will thereby derive an annual income of half a million kroner (about £25,000), has erected a 40,000-kVA outdoor sub-station beside the Follum mill for transforming the overhead-line voltage of 130 kV down to 6 kV; and for paralleling with the works generating plant and the Norderhov municipal water-power station through a 4,000-kVA, 500-6,000-V transformer.

Thirteen paralleled underground cables convey the power from the sub-station to the new boiler house containing three electrode boilers, each of 15,000 kW at 6,000 V with a steam pressure of 25 atmospheres. During tests one of the boilers carried a load of 21,000 kW for a short time. Each boiler is equipped with two sets of electrodes of 7,500 kW each, each set having its own automatic oil-immersed switches and meter panel.

Forty-two Tons Per Hour

Two of the boilers, the third being in reserve, supply steam (30 tons per hour in summer and 35 tons per hour in winter) to the wood-pulping machinery in the Follum mill, as well as to two neighbouring plants that use together seven tons of steam per hour. Two boiler feed pumps, one of which is a standby, are each capable of delivering 60 tons of water per hour at a pressure of 32 atmospheres. Each is directly coupled to a 100-h.p., 2,950-r.p.m. motor.

Beside Hannemann controllers, the boilers are fitted with automatic power regulators that may be set to maintain any load constant between the limits of 1,750 and 17,500 kW. The regulators are actuated by impulses derived from water-level contacts that energise relays governing motor-driven feed pumps, which adjust water admission in accordance with steam output.

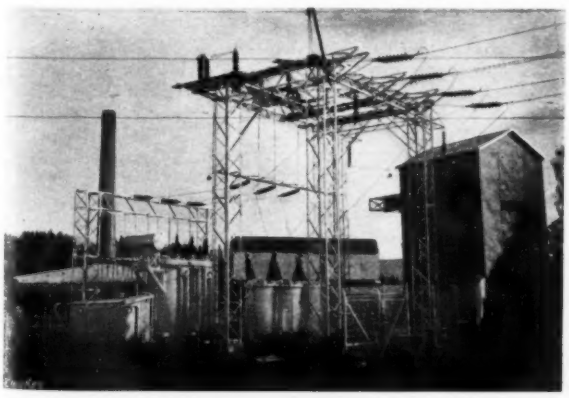
In addition, automatic steam-pressure regulators are provided for adjusting the boiler load in association with a Ruths heat-storage accumulator of 220 cu. m. capacity, steam passing to the cellulose factory through a reducing valve that lowers the pressure to eight atmospheres.

The Follum paper mill near Hönefos, where three large electrode boilers have been installed

The Ruths accumulator smooths out variations in process steam consumption, thus permitting the electrode boilers to operate at constant pressure; and also contains sufficient reserve of steam to keep the process plant going in the event of temporary short stoppages and irregularities in operation.

One of the two paper-making machines is the largest in Norway. Its output capacity per minute is 340 metres of paper six metres wide. These machines use steam at a pressure of two atmospheres, condensate being returned to the feed-water tank in the boiler house. Deconcentration from the boilers is also led back to a pipe spiral inside the feed tank, so helping to raise the boiler-water temperature and reduce heat losses.

The electrode boilers were supplied by the A/S G. Hartmann, the transformers by the A/S National Industri, and other electrical equipment by the Norwegian branch of the Allgemeine Elektrizitäts Gesellschaft.



The 40,000-kVA sub-station erected beside the mill to transform the overhead line voltage from 130 kV to 6 kV

Extensions at Yallourn

PREPARATIONS are being made by the Victoria Electricity Commission for the completion of the first part of the extension programme at Yallourn power station. It is considered that the third 25,000-kW generating set and steam-raising plant will be required by the winter of 1937. The new plant will require the erection of another high-voltage line from Yallourn to Richmond; plans for this line were approved as far back as 1928, but up to the present the demand for power has not justified its erection. When the new generator is installed, the normal output of the extended station at Yallourn will be 65,000 kW and, given favourable operating conditions, it will carry a load of 75,000 kW. The installed capacity of the whole power house will be increased to 150,000 kW. As the station can safely deal with an output of 65,000 kW, the Electricity Commission has decided to provide a further 25,000-kW set and steam raising plant after this one has been installed in 1937, making four additional plants since 1932, and the capacity will then have been increased by 100,000 kW. Originally, the extension plant was estimated to cost £2,200,000, but there has been a saving of £110,000, and falling prices may effect further economies. The cost of the complete extension by 1940, with an installed capacity one-third greater than that decided upon in 1928, is estimated at £2,263,000. So far the Electricity Commission has spent £1,314,407 of this amount, and this year it is probable that a further £40,000 will be expended. The second part of the programme is scheduled for 1938, when two high-pressure turbines, each capable of an output of 12,500 kW, will be placed in commission. In 1939 two boilers for these turbines will be installed. The fourth and last stage will be in 1940, when another 25,000-kW turbo-generator will be erected.

Engineers and Business Matters.

By R. H. Rawll, A.M.I.E.E.

The necessity for a broader outlook

THE vast majority of the technical members of the staffs of the electricity supply industry seem to have a decided prejudice against interesting themselves in the non-technical branches of their profession, and they often fail to appreciate the degree of importance of these departments. The electricity supply industry depends to a far greater extent than many other industries on a high standard of technical knowledge and experience on the part of those engaged in its service, but the technical man's frequent lack of interest in non-technical matters is producing some curious effects at present, both directly and indirectly, as regards the future status of engineers and the efficient development of the industry as a whole.

So much of the professional time of the average staff member is occupied in dealing with technical matters that, subconsciously, he has a tendency to consider the technical side as the be-all and end-all of the profession.

The present age of ever-increasing specialisation is, of course, primarily responsible for this state of affairs, and this is particularly true with regard to the young men now entering the industry. A young man may have received a good all-round, balanced training, both theoretical at college and practical in works, but with the tendency of the industry to develop more and more on the lines of specialised sections which are concerned with developments of a highly technical nature, it is safe to say that for quite a number of years at the commencement of his professional career he will be engaged on purely technical work. This degree of specialisation appears to be one of the prices paid for progress.

Qualifications for Promotion

One cannot but be impressed by the number of complaints which from time to time appear in the correspondence columns of this journal from presumably keen men in the industry, who apparently are discontented because promotion never comes their way and are discouraged when another man, whose qualifications, in their opinion, are inferior to their own, is appointed to a position of greater responsibility. There often exists also a sense of disillusionment when such complainants rather bitterly express the view that, from the economic standpoint of payment for services rendered, the long years of technical study required to obtain degrees, membership of engineering institutions, etc., are a very poor investment.

If, however, the person with such a grievance would only calmly consider *all* the qualifications of the other man who has gained such promotion, he would find in many cases that although his rival may not be such a brilliant man technically, he has, nevertheless, a decidedly broader knowledge of those other matters which become of increasing importance as one ascends the ladder of administrative and commercial responsibility as distinct from purely technical responsibility. Real commercial and administrative ability is always recognised as of greater monetary value than the possession of pure technical skill and knowledge as such, and the plums in the profession invariably go to those possessing the former qualifications.

The main object of any supply undertaking must be not only to give good service and a reliable supply, but to sell the greatest number of units to the greatest number of consumers in its area at the lowest possible price. Recognition of this fact is shown in the greater attention which is now being paid to the commercial development of distribution throughout the country and the official consideration of many of the factors involved by the McGowan Committee on Distribution which is now sitting. The question, therefore, has now to be faced whether the engineering side of the electricity supply industry has the personnel at present within its ranks who can adapt themselves with success to this new development, or whether the commercial staff will, in future, be recruited from persons with little or no engineering training.

A Technical Background Desirable

There is one school of thought which is of the opinion that in the business-getting side of the supply industry, technical knowledge is unnecessary. But I am decidedly of the opinion that the man with the technical background is a far greater asset to his undertaking in the long run than the person who is purely and simply a salesman, with no thorough understanding of the commodity with which he is dealing. Therefore, providing a technical engineer can adapt himself to the commercial side of things, he should be preferred to the man without technical training in the industry.

After all, the art of selling electricity is not merely selling irons, radiators, vacuum cleaners, etc., and it is in such cases as the negotiation of supply tariffs with prospective consumers in the face of facts and figures brought forward by the gas interests or heavy oil engine concerns that the value of actual technical knowledge and experience shows itself with unquestionable effect in reinforcing pure commercial ability.

There are, of course, many other non-technical branches of electricity supply work, knowledge of which is also essential to the engineer who wishes to progress in his profession, and the question, therefore, has now to be considered as to the manner in which this knowledge can best be obtained by the man who is engaged for the greater part of his time on technical work.

Although it is customary for the young men who are now passing through technical colleges and universities to receive training in economic and administrative matters as part of their curriculum, it is only natural, on account of their work in the electricity supply industry in the early years of their career usually being solely of a technical nature, that much of this theoretical knowledge is soon forgotten, and their attitude of mind towards the other sides of the industry soon becomes exactly similar to that of the comparatively older men, who have already served a number of years in the industry.

What Undertakings Might Do

It is true that many supply undertakings have instituted excellent training schemes for young men entering their service, but the sole object of the majority of these usually appears to be to ensure that the men concerned obtain experience in the various technical sections and departments of the undertaking, and although a good general knowledge may be achieved thereby, little or no training is given in commercial or kindred matters. Such undertakings should encourage their men to interest themselves in these non-technical matters by including experience in such work during the course of their training, which would supplement in a practical manner the theory which has been gained at college.

Undertakings could also do much more than at present in interesting and encouraging their regular technical staff in these other matters by a judicious allocation of duties, which undoubtedly would be to the ultimate benefit of both parties. Since, however, it would appear extremely likely that the present organisation of the duties of the technical staffs of the electricity supply industry into watertight compartments would allow little or no opportunity for official experience in non-technical matters, it seems that for the time being it must be left to the individual himself to decide the best means of acquiring this knowledge.

Such a man, of course, might obtain good books on the particular subjects concerned, or undergo one of the excellent courses of correspondence training which are now available; but these cannot usually be carried into effect by the average engineer with a supply undertaking, who, for obvious reasons, has neither the opportunity, inclination nor time for such a course of private study of non-technical matters. For these reasons I suggest that the following methods might be adopted, which, although they require a definite effort on the part of the individual concerned, should result in a greater interest in and knowledge of the non-technical sides of the profession with very little encroachment on his spare time.

Staff, Organisation, and Accountancy

Dealing first with administrative ability: this can only be achieved by practical experience, but since even a junior engineer generally has at some time the control of men, the opportunity should never be lost to study the reactions of individuals to different methods of approach when giving instructions for or discussing methods of carrying out particular work. The prime object should always be to create a team spirit amongst the men and staff for which one is responsible, since "to lead" is infinitely of greater value than merely "to control."

Efficient organisation plays a very important part in modern industry and it is useful for an engineer to study the organisation, not only of his particular job, but also of his staff, in order to ascertain whether they are capable of improvement. Many engineers will accept without question the existing organisation and methods laid down by the man who previously did their particular job. The organisation and allocation of responsibilities to individuals of the whole undertaking can be studied by constructing a "tree," and it is instructive to privately determine in one's own particular personal view how this could be amended to achieve much more efficient working.

Accountancy is a closed book to most engineers, who cannot get interested in it, although it is on the state of affairs as portrayed in terms of £ s. d. in balance sheets, etc., that the progress of an undertaking is mainly judged by committees or boards of directors. The methods of raising new capital should be studied, and also the considerations and regulations governing the decision whether items of expenditure should be

charged to revenue or capital. It is further desirable that the broad principles of the particular costing system adopted by an undertaking should be mastered.

It may be wondered how it will be possible to obtain even a working knowledge of such highly specialised subjects as accountancy and costing as applied to electricity supply work. An engineer desiring to secure such knowledge should have friendly chats with a responsible member of the accountant's staff with consequent benefit to them both.

To be able to dictate a letter readily and efficiently is a decided asset to an engineer, since practically every position involving administrative responsibility necessitates correspondence. Unfortunately, many engineers find this difficult, but several things can be done in the meantime to develop facility of self-expression. Most engineers, for instance, as part of their routine work, have to make out reports, and these should always be expressed concisely and in a non-ambiguous manner. The preparation and writing of articles of general interest for publication in the technical Press is another useful exercise in expression. Taking part in discussions at meetings of engineering institutions and other societies will also be of material help.

Sales and Development

As regards the sales and commercial development side of the undertaking, there are many ways in which an engineer can not only acquire useful knowledge but also at the same time materially assist his undertaking in this connection. It is a surprising fact that there are members of the technical staffs of undertakings who are practically ignorant of the various tariffs offered by their undertakings and the facilities available for the purchase, hire, etc., of apparatus—particularly in the domestic field. It should be the duty of all such men to be in possession of this information, since in their own social circle numerous opportunities inevitably occur for spreading the electrical idea. Occasional visits to the undertaking's showroom and a comparison of the display methods there adopted with those of the showrooms of other supply undertakings and the gas interests are decidedly of an instructive and interesting nature.

Apart from the national electrical propaganda undertaken by E.D.A., each individual supply authority usually adopts effective local publicity methods. In this direction members of the technical staff can often be of great assistance by notifying those responsible for publicity of effective local media of advertising value which come to their notice, such as magazines, concert programmes, etc., and by suggesting the most effective sites in the district for display advertisements and posters.

An engineer also may hear of the contemplated extension of a factory or the demolition of houses for the erection of flats. In such circumstances an early hint to the commercial side of the undertaking may result in contact being made with the persons responsible for such developments, and load obtained for the undertaking, which at a later date might be impossible to secure.

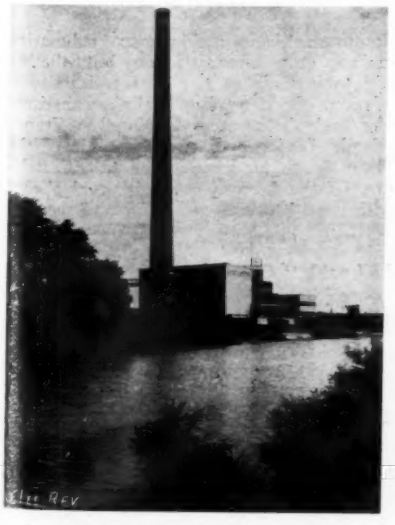
Although an engineer cannot be expected to master all the intricacies of electricity supply legislation, for even lawyers disagree regarding the interpretation of certain provisions, it is most desirable that a working knowledge of an undertaking's statutory obligations and rights should be acquired. There are several excellent reference books dealing with this subject which are well worth having. Particularly is it essential to have a good exposition of the provisions of the Electricity (Supply) Act, 1926, which set up the Central Electricity Board, and a good working knowledge of the Electricity Commissioners' Regulations and the Electricity Regulations for factories and workshops.

Every technical man should have a good knowledge of the organisation of labour in the electricity supply industry and the different rates of pay, together with the machinery which has been set up to deal with disputes, as well as the operations of the National and District Joint Boards, with which they are usually familiar as a matter which immediately affects their own salaries.

I fully expect that many will object that the subjects suggested in this article are so numerous that even with the best will in the world, the average engineer would find very little time to acquire this knowledge. The whole purpose of this article, however, is not to suggest that a man's spare time should be occupied in intensive study of the subjects outlined here, but first of all to arouse in him interest in branches of electricity supply work other than the technical, and then to acquire a habit of mind of recognising and taking advantage of every opportunity presented during the course of the day's professional work which may bring him knowledge of this new character and thus broaden his outlook. Even if it is only successful in breaking down the decided prejudice at present prevailing amongst the majority of the members of the engineering staffs of supply undertakings towards non-technical matters, this article will, I think, more than have achieved its object.

Modern Power Station Design

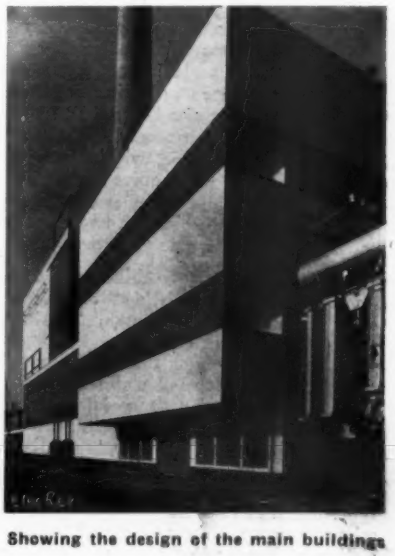
THE "Esso" power station of the Corporation of Electric Power Stations in the Central Elbe district at Kolín, Czechoslovakia, consists of several groups of buildings:—Machine buildings (with railway sidings), including boiler house, engine house, pump house, switch house, oil-store, a construction and repair shop, coal bunkers and auxiliary buildings, office building with departments for administration and clerical work, the design of primary mains and transformer stations, for secondary mains and for electric meters; store rooms; garages and workshops; and residential quarters, comprising a house for the manager, houses with two and four flats for foremen, and houses with twelve to fourteen flats for employés, which are separated from the power plant.



A general view of the Kolín station

The coal dump can accommodate 6,000 cu. m. of coal. The coal is automatically transported from the dump to the hoppers (height 20 ft). The firing floor is six metres above the ground and the two chimneys are 120 metres high. Auxiliary rooms, offices and laboratories are connected to the switch house next to the boiler house. To the east and north-east of the switch house are the transformers, alongside of which runs a railway line. On the other side of this line a large switch house and oil store-room are situated.

The first building section contains the power plant for half of the ultimate scheme. The boiler, engine and pump houses are of steel-girder construction. The foundation area of the engine house is 800 sq. m., and that of the boiler house 1,150 sq. m. The dividing walls are of light concrete and fit into the steel construction of the walls. "Wema" forms were used for the glass walls and are built into frames. The solid ceiling is covered with cardboard, a 5-cm. thick layer of cork cemented with paint and a bitumen layer. The flooring is of heavy concrete or tiles.



Showing the design of the main buildings

The switch house, connected to the engine room, is independently built of ferro-concrete. The flooring under the accumulators is asphalt, and terracotta tiles form the flooring in the rooms of the switch house, otherwise the floors are made of india-rubber or cement.

Long-distance Telephony

Some recent work by the Post Office

SOME of the development work recently carried out by the Post Office is referred to in the paper by Mr. A. C. Timmis, which was read at the Institution of Electrical Engineers in London on January 16th. The author explains that nearly all aerial (open wire) trunk lines are now worked as ordinary loop circuits, without phantoms, and that d.c. signalling is used to facilitate operation. The mains-operated P.O. system of single-channel carrier telephony is being employed to an increasing extent not only as a means of obtaining more circuits without adding wires or phantoming, but also because the carrier circuit can be adjusted and maintained so that its overall equivalent (measured attenuation between terminals) is practically zero; and it is almost unaffected by inductive disturbances.

About a dozen carrier circuits of this type are now in use, mostly in Scotland, and others are being installed in various parts of the country. On some of the railway companies' lines single- and three-channel carrier systems of other types are used, and there are a number of power-line carrier telephone installations. The number of long circuits provided by open-wire lines will decrease. The P.O. single-channel carrier system costs less than erecting wires (on existing poles) even for 30 miles or so.

The Underground Cable System

Aerial lines are only used to a limited extent for junctions and short trunks. In the underground cable system there are about 40 repeater stations, housing from 20 to 700 repeaters. In addition there are 1,300 toll repeaters (simplified and mains operated) on minor lines and this number is rapidly increasing.

The line attenuation permissible between two-wire repeaters is now generally limited in practice by instability rather than cross-talk. The fundamental difficulty of equating line and balance over the working range of frequency is evaded by the use of a voice-operated switch, which increases amplification in the direction of speech while reducing it in the opposite direction. This form of stabiliser or reaction suppressor is more convenient than frequency changing.

When idle (*i.e.*, when both ends of the line are disconnected) all repeated circuits, both two- and four-wire, are now automatically closed at the exchange ends by 600-ohm resistances. This simple form of partial stabilisation improves the overall equivalent of all two-wire repeated circuits from 3 to 7 db.

Under the best conditions a two-wire circuit cannot be quite as stable as a four-wire one, but with modern cables the difference can be made less than 2.4 db, and the minimum stable equivalent (with ends open) kept below 2.75 db, which has been proved safe on zero-loss circuits. A four-wire repeater consists simply of two amplifiers, one for the " go " and the other for the " return " line. The standardised main line P.O. type provides a maximum gain of 40 db when used as a " flat " amplifier.

Echo suppressors are necessary in long trunk circuits. The valve type has some advantage over the valve and relay type, but an improved pattern has recently been invented in which valves are replaced by copper rectifiers. Instead of the repeater amplification being reduced by the application of negative grid voltage, variable attenuators (consisting of series and shunt rectifiers) are used in front of the repeaters. The valveless suppressor can also be used in a two-wire repeater, which has not hitherto been needed. But recent cable improvement has made it practicable, within certain limits, to work two-wire circuits at zero equivalent. Considerable economy of circuits will result if sufficient stability and transmission efficiency are obtainable with two wires; the London-Liverpool cable is now working in this way.

A Stabilising Device

It is important to distinguish between this useful limiting effect of an echo-suppressor and " stabilising " (or preventing any singing current from building up). The latter is the function of a reaction suppressor, but the operation of the impedance-valve type of stabiliser is limited by two factors. First, line noise may cause false operation if the device is made too sensitive; and, secondly, if it is not sensitive enough initial syllables may be lost (" clipping "). Both these troubles, hitherto regarded as inherent in any voice-operated stabiliser, have been almost completely overcome in a new type, which is to some extent a development of the valveless echo-suppressor. The new model works equally well in association with a two-wire repeater or in a four-wire line, and has important applications in the trunk service.

In the near future, long trunk cables of the type now used will probably contain a mixture of audio-frequency and carrier circuits, the latter working on different systems according to their length. It has recently been proposed to use special cables of the concentric or screened-pair type to provide a large number of carrier-frequency channels. The negative feed-back amplifier, which can handle many carrier channels without cross-modulation, is an essential feature of the scheme.

For the longer trunk circuits, the four-wire principle seems likely to be retained because of its two great advantages, of stability over the whole working frequency range, and independence of line impedance. Although, by the use of stabilisers, very long audio-frequency two-wire circuits can be worked at zero equivalent and made less sensitive to changes of impedance (such as the insertion of a length of interruption cable) in the neighbourhood of the stabiliser, they can never be quite so robust as four-wire circuits.

The modern sea cables maintained by the British Post Office may be divided into (*a*) continuously loaded, paper-core, lead-covered, such as the Anglo-Dutch No. 3 cable; (*b*) unloaded gutta-percha or balata core, such as the Isle of Man-Ireland cables; and (*c*) unloaded, screened, paper-core, lead-covered, such as the Anglo-French (1933) cable. Neither the coil-loaded nor the concentric type is much used round these shores. The former is used extensively in the Baltic, and the latter is the type most suitable for very deep waters.

The Anglo-Dutch No. 3 cable contains four quads (16 wires). On account of the symmetrical arrangements and continuous loading, the phantoms and super-phantoms are all of reasonable attenuation and their complete utilisation enables 16 circuits to be worked. A single-channel four-wire carrier system is working on each quad, giving four more circuits. The carrier frequency is 5,800 cycles, as in the system described for land cables. It is intended to equip the Irish cable route via the Isle of Man fully with carrier circuits in the near future. A temporary single-channel system is now working.

The installation at Ballyhornan is of special interest because it is housed in an unattended station. Relays are arranged to operate alarms at Belfast in case of valve failure.

Electrostatic Screening

A certain amount of research work has been done by the Post Office regarding screens at frequencies up to 50 kc. per sec., and the results may be very briefly summarised thus: In a paper-core cable a very thin screen (such as metallised paper) gives almost complete electrostatic protection. In a gutta-percha cable the sea water surrounding the cores acts in a similar way. Electrostatic screening, however, does not sufficiently reduce cross-talk at high carrier frequencies. The residual effect, which is electromagnetic, can be reduced by the use of heavy copper-tape screens, 0.016 in. or more in thickness. The thicker the screen and the higher its conductivity the less the effective resistance (and therefore attenuation) of the conductors. Copper is the best material for high frequencies. An approximate theory of the eddy-current and magnetic screening effects is given in an appendix to the paper.

The Post Office maintains considerably more submarine telephone cables than any other administration, but whether this number is likely to increase in the next few years is an interesting speculation. Short-wave radio links constitute a formidable rival for such distances as England to France and Scotland to Ireland. If, however, the sea cable of the future were buried in a trench (as some of the Atlantic telegraph cables now are, off the Cornish coast) it could almost achieve perfection with regard to both reliability and secrecy.

The Blackpool " Chief's " Salary

Blackpool Town Council last week discussed a recommendation of the Electricity Committee that applications be invited for the post of electrical engineer (to succeed Mr. C. Furness) at an inclusive salary of £1,300 per annum, rising by annual increments of £50 to £1,500 per annum. Councillor Round said that Blackpool was now generating much less electricity since the grid system was inaugurated and the salary ought to be £700 or £800 per annum, rising to £1,000. The chief constable, a far more important official, was paid only £700 per annum. Councillor Halton (vice-chairman of the Electricity Committee) said that they wished to get the best possible official and a salary of £1,300 was less than the figure laid down by the Association of Municipal Electrical Engineers. Councillor Ashton (chairman of the Publicity Committee) said that Blackpool was being watched by other resorts and an illuminations expert would eventually be needed. Alderman Whittaker (chairman of the Electricity Committee) said that 100 extra workmen had been taken on at the electricity works, as part of the scheme to reduce local unemployment. The salary recommendation was referred back.

Meetings and Discussions

Detecting Incipient Cable Faults
Miners' Lamps and Batteries
Echo Sounding Devices

Testing Power Cables

TWO papers were presented at the January 15th meeting in London of the Transmission Section of the INSTITUTION OF ELECTRICAL ENGINEERS. The first by Messrs. A. N. ARMAN and A. T. STARR is concerned with a method of measuring discharges in dielectrics (*i.e.*, ionisation) directly, not by its effect on the 50-cycle power factor. The method is based on investigations made in the research laboratory of Callender's Cable & Construction Co., Ltd. When used in conjunction with a Schering bridge it will indicate whether, in any particular case, variation of the power factor is due to ionisation or to other causes. Also it will determine whether a given dielectric is undergoing local ionisation long before the extensive treeing and coreing occur that are required for an appreciable change in the p.f. to take place.

The necessity of being able to detect discharges before they have caused sufficient damage to effect a change in the p.f. is pointed out, and the importance is emphasised of being able to differentiate between increases of p.f. due to gaseous ionisation and other causes.

The apparatus employed is described, various circuit arrangements being examined mathematically in appendices. Methods of eliminating from the measurements all discharges external to the test sample are dealt with in some detail, this being an essential feature of apparatus for use in high-voltage testing circuits.

Apart from its employment for reasearch into dielectrics and for cable testing, this detector is a useful instrument which can be used in certain cases in the design of joints, sealing ends, and similar apparatus. By preparing experimental models with suitably sectionalised electrodes and then making discharge measurements with both polarities the seat of internal discharges can be located.

The second paper, by Mr. C. KIBBLEWHITE, deals with the routine over-voltage testing of h.v. cables. The function of such tests is to reveal insulation which has been gradually weakened (by electrical stress or the ingress of moisture) by completing its breakdown before failure occurs in service. The author describes a series of tests applied to a cable network in the Birmingham Corporation area, which had been put into commission at various dates from 1906 onwards and had been operating at 5.5 kV and 25 cycles until 1931, when a start was made to increase the operating voltage to 11 kV and the frequency to 50 cycles.

Subsequent experience has emphasised the fact that the standardisation of reduced dielectric thicknesses for 11-kV cables has only been made possible by improved manufacturing technique, and that cables made by the older processes and having dielectric thicknesses of less than 0.3 in. cannot necessarily be safely operated at 11 kV. Experience indicates that suitable d.c. over-voltages for the testing of cables having dielectric thicknesses of between 0.18 and 0.24 in. are 50 kV between conductors and 35 kV between conductors and earth. The interval of time which may safely be allowed to elapse between one over-voltage test and the next depends on the speed of deterioration of cable in service, which is not known. For the network dealt with in the paper it has been decided to aim at allowing an interval of not more than six months. It seems advisable to limit the duration of the test over-voltage to a short period; in the case under consideration it was finally reduced to one minute. When applied the voltage should be raised fairly slowly; normally about one minute is taken to reach 50 kV.

From the results obtained it is concluded that systematic routine d.c. over-voltage tests will eliminate a large proportion of service breakdowns arising from deterioration of cable insulation. The over-voltage applied must, however, be considerable, if a reasonable period of immunity from breakdown is to be ensured. Approximately five times the a.c. working voltage may be suggested as a suitable value.

It is clear that the application of high d.c. voltages is not harmful to sound cable, although a certain number of joints must be expected to break down on test which would probably continue to operate satisfactorily at the ordinary working voltage. It may therefore be concluded that routine d.c. over-voltage testing may be the means of extending considerably the useful life of cable which would otherwise have to be replaced, and that by its use a considerable proportion of service breakdowns, with the dislocation of supplies attendant thereon, may be avoided.

On the network described, which consists of approximately fifty miles of low-dielectric-thickness cable split up into eighty sections, about 180 tests per annum are necessary to ensure that each section is tested at intervals not exceeding six months. One engineer, with driver, jointer, and mate, can carry out approximately 350 tests per annum if their time is wholly devoted to the work.

The cost of testing the small-dielectric-thickness cables has amounted to approximately £1,500 per annum, including salaries, wages, renewals to testing apparatus, and repairs to cable broken down on test. This represents the cost of keeping about fifty miles of cable in commission. The cost of replacing this cable may be estimated at not less than £100,000, and, even if no account is taken of the inconvenience which would be caused by replacement, the annual cost of testing is in the author's opinion amply justified by the saving of capital charges effected.

* * *

Miners' Safety Lamps

IN a paper read before the London branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS on January 14th Mr. E. Lyon contends that recent improvements in the performance of miners' portable electric safety lamps have been due to the greater efficiency of the bulbs rather than the battery. For the same size of electrodes the free acid type of battery is said by the author to give a better capacity performance, but to prevent acid leakage the container can only be half filled with electrodes. The use of "Jellac" semi-solid electrolyte reduces the capacity of the electrodes compared with free acid, but the large air space is not required, and the capacity can be increased to more than compensate for the loss.

The most interesting development has been that of the 4-V battery, made necessary by the limiting efficiency of the 2-V bulb at higher currents than about 1 A. The construction of the container called for much care to prevent intercell leakage. The free acid battery, requiring snap-on lid or sealing devices, demanded much ingenuity and involved many disappointments before success was finally achieved. The standard design for this type now appears to be two separate semi-circular containers with a common ebonite lid and solid contacts, the springs being removed to the top contact plate away from the acid. Batteries are washed out every two or three months, and the average plate life is given as fifteen months.

With "Jellac" the difficulties of sealing disappear and separate moulded lids smeared with a "tacky" solution will retain the electrolyte without any sealing or complicated joints. The standard design is now a serpentine case made from one piece of celluloid, and interconnected by the simple electric welding of lead to lead. An important point is the freedom from corrosion due to the absence of any foreign metal, such as brass. The welding is an interesting innovation to lamproom work. The equipment consists of a 4-V 40-Ah battery (or a step-down transformer) and a carbon electrode. Very little practice is required to make a perfect joint. Batteries are washed out after three months, and not touched until the end of the life at twelve months or more.

The alkaline battery is a much sounder and stronger job from an engineering point of view. The electrodes are steel pockets containing cadmium and nickel oxide, the container is of steel and the electrolyte does not attack the steel of which the lamp is made. Unfortunately the voltage of the cell is low, 1.25 V, making the use of two cells in series essential, giving 2.5 V per battery. Thus the advantages outlined are to some extent countered by the complication, in construction and commission, of the necessity for two cells without an appreciable increase in voltage.

The materials give the designer more scope, as shown by the almost universal adoption of the two-piece lamp construction, in which the battery is an integral part of the lamp, so saving much time and labour in the lamproom. Topping-up equipment can be made on a much sounder basis, more exact and speedy, and the attention required is less than that required by an acid battery, all of which has a bearing on the ultimate cost. For the same capacity and light output the alkaline type is more bulky and heavier than the equivalent acid type.

The 4-V gasfilled bulb with a vertical spiral filament has an output of 8 lumens per watt, compared with 5.26 for the 2-V vacuum bulb. The 2.5-V alkaline lamp bulb is rated at

7 lumens per watt, having a shorter and also thicker filament.

The luminous efficiency, *i.e.*, relation between light output of the bulb alone to that of the complete lamp as a unit, varies from 45 to 55 per cent., depending on the dimensions of the dome and lamp top and on the obscuration factor of the wellglass.

An average alkaline lamp has a light output of 1.45 lumens per lb. weight. A "Jellac" 4-V lamp provides 1.96 lumens per lb., based on Mines Department published approval figures, while a 4-V free acid lamp is stated to provide 1.57 lumens per lb. Schedule A lamps must use an approved bulb, of specified candle-power.

* * *

Marine Echo-Sounding

ECHO-SOUNDING equipment for ships is dealt with in a paper by Capt. J. F. HUTCHINGS that was read before the INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND on January 14th. A sound is transmitted downward from the ship's bottom through the seawater to the ocean bed, whence it is reflected upward and picked up by a hydrophone in the ship's hull. The author explains that the method is independent to a great extent of both speed and depth, and it enables an intimate trace of the profile of the sea bottom to be produced on a chart. Soundings taken at the rate of 96 per minute and a speed of 10 knots means a spacing of little more than 10 ft. apart at the bottom.

The magnetic hammer system was adequate for moderate depths, or for ships having low speed, but was not sufficiently powerful for great depths and high speed. This led to the introduction of the pneumatic hammer, in which an electric current passing round a coil operates a small valve, admitting air pressure to the hammer. Thus the consumption of electricity is very much smaller, while the blow struck is much stronger, and is also productive of a tuned note. Another system of oscillation on the sonic range of frequencies is that known as the "Fessenden," in which a diaphragm of comparatively large diameter is vibrated by a magneto-electric system at a frequency of from 1,500 to 2,000 cycles per sec. The frequency is determined by the current oscillation, and the signal is sent out immediately the a.c. operating the oscillator is switched on.

The transmitter and receiver must be separated so that the direct action does not eliminate the echo. The athwartship arrangement has been used for deep water with the pneumatic hammer. In the fore-and-aft direction the separation is usually as much as 50 or 60 ft. It is usual to put the hydrophone forward, as it is less affected by ship noises, water noises, and aeration. With this separation, the depth scale as it approaches zero must become very compressed and hard to read just when precision is wanted, so that the system is of little use in shallow water.

The advantage of the sonic system is its penetrative power, so it is still used for deep-water sounding, or in survey ships. Thus the *Challenger* has charted much of the Atlantic with this gear; the *Mahabi*, of the Murray Expedition, was so fitted, with excellent results, and the new non-magnetic survey ship will probably be so fitted. Several liners are also equipped with this apparatus. The sonic apparatus cannot obtain soundings very close to the bottom of the ship. It is complicated, and the fittings in the bottom of the ship require a certain amount of attention. It makes a noise that can be heard in the ship, and it is affected by ship noises. However, by passing into the supersonic range of frequencies one can avoid most of these disabilities at the price of penetration. The higher the frequency, the less the penetration, and it does not matter how big a sound is made, it always travels at the same speed. The first supersonic oscillator was produced by Langevin, using the properties of the piezo-quartz crystal. It has a frequency of from 30,000 to 40,000 cycles per sec., and is the basis of the Marconi "Echometer." Due to its high frequency it has a low penetrative power, and is useless for deep sounding. It is necessary to place the oscillator outside the hull of a ship, as the plating would absorb the sound.

To cover all the requirements of ships it is necessary to find an oscillator having a frequency lying between the piezo-quartz and the hammer. This has been achieved by the Admiralty scientists in making use of the magnetic properties of nickel, and the result is the magneto-striction oscillator. The standard type has a frequency of 16,000 cycles per sec. which has great penetrative power, and so not only is capable of sounding to depths of over 1,000 fathoms, but also avoids the necessity of cutting the hull plating. The principle of working is based on the fact that nickel alters its length under the influence of a magnetic field. A "pack" of nickel stampings of annular form is wound toroidally with large-gauge insulated wire. The transmission signal is made by discharging a condenser through this winding.

The effect of this is to set up a violent oscillatory current in the winding, which, however, is speedily damped out. The current sets the nickel pack into vibration, and this is passed to a reflector and there diverted into a beam having a half-angle of about 21 deg. round a vertical axis. The condenser is originally charged by an inductive charger, and the charge is renewed between signals. Thus the process is repeated for each sounding. For reception, the converse process takes place, with the proviso that the nickel pack is first "flashed," or magnetised.

Being supersonic, magneto-striction oscillators are not affected by ordinary noises, and they make practically no noise at all; nothing can be heard except a slight click Further, the supersonic noise is not so easily conducted through the steel of the hull, so that these oscillators can be placed comparatively close together.

* * *

How to Reduce Transformer Noise

OPENING a discussion at the JUNIOR INSTITUTION OF ENGINEERS in London on January 2nd on the suppression of noise made by engineering plant, Mr. D. W. MCJANNET made special reference to noise arising from the operation of electric transformers. It was pointed out that the growth of domestic electrification forced electricity distributors to place transformers near the load centres, which meant in the midst of residential property. Further, the increasing difficulty of finding land for sub-stations necessitated a number of units being placed outdoors. The frequency of the note emitted by a 50-cycle transformer was 100 cycles, the noise being independent of the direction of the flux, and, while not unpleasant for a short period, if continued indefinitely, and specially during the night, was apt to become irksome and, finally, nerve-racking.

The noise might be suppressed to some extent by suitable screening of the transformers. In America the planting of hedges in strategic positions had been tried with some success. Noise might also be transmitted through the transformer foundation, and this could be effectively dealt with by placing the transformer on a raft of either metal or concrete which "floated" on the main foundation, suitable pads of "Cotocil" (a cork-like substance) or of rubber.

Recent improvements in transformer design and manufacture had, while aiming mainly at other ends, tended to quieten their operation. Interleaved cores and improvements in core clamping had all helped, and it was along these lines that further improvement could be expected. A reduction in flux density by 15 per cent. had reduced the noise emanating from the core by 50 per cent. All transformers now constructed for the Central Electricity Board had an induction density of 11,000 lines per sq. cm., the primary object being the reduction of harmonics, but it also made the transformers much quieter in operation. Noise also arose from mechanical vibration within the transformer, and to prevent its transmission to the tank walls the core should stand on a prepared cork slab and any adjacent structure be insulated from the tank by cork washers and packing. The copper risers from the end of the windings, often of some length, should be cleated at more frequent intervals to minimise vibration, while the windings should be braced by coil supports to keep down noise caused by loose coils. The cooling tubes of the tank might vibrate and cause noise, which could be overcome by fitting wooden cleats along the tubes, thus clamping them together and altering their natural frequency.

As it was impossible to produce iron-cored apparatus which would not produce some measure of hum, the only real solution was the housing of the transformer in a specially designed soundproof sub-station, which was an expensive but a very real solution.

* * *

Trends in Illumination

Some tendencies in the lighting of buildings are reviewed in the paper by Mr. J. B. HARRIS which was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on January 10th. For direct illumination opal ceiling spheres are stated to be effective and efficient; luminous columns, beams and laylights are also considered and figures quoted to indicate the efficiencies of panels of various shapes. Indirect lighting from the cornice and by troughs and torchières is considered. Attention is drawn to the importance of "selective discoloration" in exterior floodlighting, while "sunlight" and "daylight" tubing is dealt with.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

The Glare Problem

I have read with great interest Mr. D. G. Sandeman's article on this subject which appeared in your issue of January 10th, and would congratulate him on this valuable addition to our knowledge of the subject of street lighting.

Many years ago when I first introduced directive lighting to this country I found by trial and error that five degrees depression was the best angle for the maximum candle power of the longitudinal beams, and the reflector fittings were made for that angle. The fact that hundreds of thousands of these fittings are now in use proves that Mr. Sandeman's reasoning is correct, and that the public and the public authorities who selected this type of fitting, on account of the good visibility and lack of inconvenience due to glare, were also right in theory.

Unfortunately some of the users of these fittings have increased the angle of depression in order to bring up the half way (minimum) illumination to obtain a higher grading under the British Standard Specification for street lighting, but this is to be deplored. HAYDN T. HARRISON.

London, S.W.16, *January 10th.*

"Technical Data on Fuel"

Our attention has been drawn to the review of "Technical Data on Fuel" (fourth edition) which you have been good enough to publish in your issue of January 3rd. In the course of this notice you state that the text of this book has been expanded by seventy pages since the first edition was published in 1928. We wish to point out that actually the increase of seventy pages represents the increase of the fourth over the third edition; the additional number of pages, by comparison with the first edition, is more than 200.

For the British National Committee,
C. H. GRAY.

London, W.C.2, *January 9th.*

"D.C. Voltage"

I must say that I agree with the writer of the letter in your last issue that the letters "d.c." and "a.c." have been employed in an adjectival sense for years to describe anything associated with direct or alternating currents, and I do not see why they should not be employed to specify the type of voltage. G. W. O. HOWE.

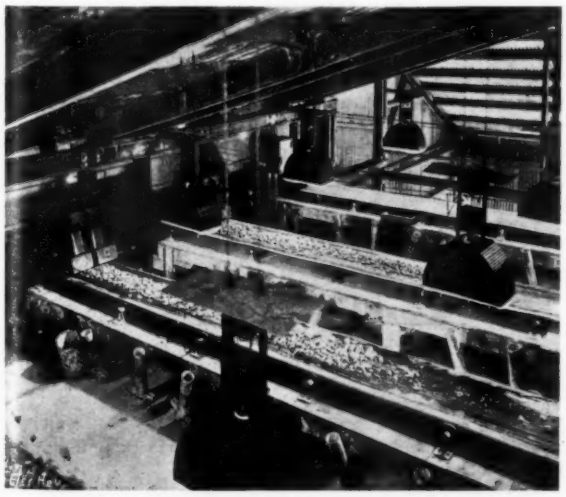
University of Glasgow, *January 8th.*

In his letter in your last issue Mr. A. W. Chown Hirst disapproves of my criticism of Mr. Whiteley's use of this term on the grounds that it is merely an abbreviation for "direct-current producing voltage." Everyone knows, of course, that this is what is meant, but that does not alter the fact that "d.c. voltage" is an unsatisfactory term.

It is reasonable to speak of the "d.c. resistance" of a circuit or an instrument, for example; meaning thereby the resistance of the circuit or instrument appropriate to the direct current. Similarly there is no inconsistency in the use of "d.c." as describing any instrument or apparatus designed for operation by direct current. But Mr. Whiteley's use of "d.c. voltage" is different. He is referring to a source of difference of potential of constant direction and magnitude which is independent of whether there is any current flowing, and if there is a current, of whether this current is direct or alternating of high or low frequency.

I believe that this question has been discussed many times by nomenclature committees, but that no decision has ever been reached. I suggest tentatively that the expression should be replaced by "constant voltage." I would not object to "d.c. supply" in Mr. Whiteley's case. But not "d.c. voltage." C. L. FORTESCUE.

City and Guilds Engineering College, S.W.7.
January 13th.



The illumination of ore-conveying belts at the Crown Gold Mines, Johannesburg. The equipment consists of 400-W "Osira" electric-discharge lamps in concentrating reflectors

"Do We Compete with Gas?"

With regard to my article in your issue of December 27th I am afraid that "Pro Electricity" has rather misunderstood my attitude; that I am all for electricity should be apparent from my concluding paragraph.

However, it is a grave error to underrate one's opponent, and to think that gas competition can be dismissed with a wave of the hand is a bad mistake. The gas wall switch that does not require a pilot light is comparatively new, although I mentioned no age, simply stating that such fittings are becoming common. Thousands of consumers in my home area are paying 6d. per kWh for lighting, and in other districts even more is being paid. Such electricity cannot be called cheap.

Reduced to the plainest terms: from the customer's point of view, a two-part tariff simply means that the more he uses the cheaper will be his unit. I am sorry to say it, but I know of several places where gas has been reinstalled; cost has been the chief reason, but a badly planned electrical installation has also had something to do with it. Two-way switching, twin lamp pendants, &c., are not "conveniences," they are necessities, and the smallest electrical installation should include them, as I am sure "Pro Electricity" will agree.

January 11th. SALESMAN.

Public v. Private Supply

The author of the article on "Conversion to Public Supply" in the ELECTRICAL REVIEW of January 3rd has discussed only one aspect of the question of industrial electrification. There is, in some areas at least, another one, *viz.*, not "how to overcome objections to *scrapping* private plant" but how to prevent it being installed. It may perhaps at first seem absurd to-day to suggest seriously that such an aspect should exist, but the unenterprising tariffs existent in some localities do actually render it a very real problem.

It is naïvely suggested in the article that the consumer can use his existing private plant to keep down his winter maximum demand, taking the rest of his load from the public mains. Unfortunately the supply authorities often put a bar in their supply contracts against the use of any other form of power whatever. Such methods give no encouragement to the increased use of public supply. Where the tariff is a very low one a bar in the contract would be unnecessary, as the consumer would naturally use electricity, but where such is not the case, and the maximum demand charge of the two-part tariff constitutes a large proportion of the annual cost of electricity, the factory engineer has considerable difficulty in justifying any extended use of the public supply.

The incidence of the factory lighting load upon the peak production power load during some at least of the winter months in some industries makes matters worse, and with a high maximum demand charge only encourages the use of as little lighting as possible, or else some other form of illuminant. It seems high time that electrical illuminating engineers took a hand in such matters to prevent the imposition of tariffs which are a deterrent to adequate lighting in factories.

The incidence of the winter lighting load upon the normal factory load implies a corresponding increase in kVA of maximum demand, and with a maximum demand charge of 10s. per month plus, say, 0.5d. per kWh, the resultant cost of the lighting works out at nearly 3d. per kWh. This seems hardly a price which will encourage liberal use. In some places until recently it has been the practice to have an annual kVA charge which applies for the whole year quite independently of when the load is taken. In the example just quoted—which relates to a factory consuming nearly three-quarter million kWh per annum—the cost of the lighting worked out at nearly 7d. per kWh. Obviously during that period no more lighting

was installed than was absolutely imperative, and when lights were on, other plant had to be shut down to limit the demand. There was irony in the fact that many of the employés could at that time go home to lighting for which they paid well under 1d., including the fixed charge of a two-part tariff.

In cases such as this, even with the more favourable present-day monthly kVA charge, in lieu of the annual one, the factory engineer has no encouragement to add to his load anything such as process heating, which can be obtained by other means (gas, steam, &c.). In many cases sacrifice must be made of the greater convenience and other advantages of electric heating where the cost difference is so great—but such a state of affairs is really detrimental to the furtherance of electrical development, and to increasing the grid load.

The offer of an alternative tariff which gives lower rates only provided that no load is taken during the afternoon and evening hours of the winter months is useless for most industries where female labour is employed, since that cannot be used on night shifts when the power is available.

Unless the grid supply is so rearranged that there is ample ability to meet all demands upon it *at all hours* without the imposition of crippling m.d. charges, the only adequate solution from the factory users' point of view, seems to be private generation of all electricity used, unless they are allowed to use their own plant to relieve the maximum demand during the winter months—an alternative that has very much to commend it.

PHILIP R. COURSEY, M.I.E.E.

Richmond, Surrey, *January 6th.*

The Two-part Tariff.

By F. J. Elliott, A.M.I.E.E.

Is the rateable value basis equitable?

THE multiplicity of charges existing to-day is the result of years of endeavour to formulate technically correct tariffs which will ensure that the charge to each consumer relates to the cost incurred in affording his supply, and the resultant chaos indicates the impracticability of the idea. There is a tendency to accept ½d. as a just, economic, and competitive figure for the "unit" charge, but the method of arriving at the fixed portion of a two-part tariff is a more controversial matter. Yet it is the more important of the two components, because it can convert the ½d. per kWh into any figure.

The E.D.A. report on "Electric Service in the Small Household" states that the exact method of calculating the fixed charge does not matter very much, so long as it is understandable. It then suggests the adoption of the basis recommended by the Electricity Commissioners, *i.e.*, size of house. But does this method comply with the condition laid down as to its understandability?

It may be assumed that the average consumer does not understand the relationship between the size of his house and the cost per kWh for electrical service, and we in the industry are finding it increasingly difficult to substantiate the claim to equity of this basis of charge. Is it not time it was realised that consumers have not made a sufficiently close study of the economics of electricity supply to appreciate the scientifically accurate tariff and that they invariably use the yardstick of common sense and ordinary commercial principles when judging the value of the services received?

The standing-charge component of a two-part tariff, whatever basis is used, is fixed at such a figure as to cover the assumed standing charges created by the consumer's maximum demand after allowing for diversity of the group of consumers. The figures published relating to the Hull housing site show a load factor of 55 per cent. based on generation peak and 17 per cent. on local distribution peak, but these relate to a group of consumers in receipt of incomes within a defined range and each having apparatus for specific uses, namely, lighting, cooking and washing. Given larger houses, bigger incomes, more apparatus, *e.g.*, the addition of water heaters and room heating, it is only reasonable to conclude that different diversity would result, necessitating a different tariff, but the consumer in each case is purchasing the same services, namely, light and heat.

Comparative Figures

Table 1 shows the kWh obtainable for varying annual expenditures and rating assessments of £16, £32 and £60 per annum under a representative two-part tariff of 12½ per cent. of the rateable value up to an assessment of £40 or so, decreasing to 10 per cent. above, and a running charge of ½d.

TABLE 1.

Annual expenditure.	Fixed charge and no. of kWh.		
	£2.	£4.	£6.
£4	960	—	—
£8	2,880	1,920	960
£12	4,800	3,840	2,880
£16	6,720	5,760	2,800
£20	8,640	7,680	6,720

Are we satisfied that the standing costs of supplying a group of houses rated at £32 per annum are double those where the houses are rated at only £16 per annum and are trebled for a £60 per annum assessment, or does our much boasted scientifically correct tariff resolve itself into the old railway adage: "Charge what the traffic will bear"?

The consumer must of necessity use the only method of comparison available, *i.e.*, the quantitative basis "What do I obtain for my expenditure?" "How many kWh per £1 of expenditure?" or "How much per kWh?"

The following tables 2 and 3 answer these questions satisfactorily perhaps to the supply undertakings, but undoubtedly to the consumer's amazement and dissatisfaction.

Using the accepted principle of scientifically calculating the cost of affording a supply to groups of consumers by dividing those costs into fixed and running charges and passing the costs on in the same way to the consumer, then the fixed portion of the charge must vary with the diversity and the consequential load factor associated with that group; it will also

TABLE 2.
kWh obtained per £1 expenditure.

Annual expenditure.	Fixed charge.		
	£2.	£4.	£6.
£4	240	—	—
£8	360	240	120
£12	400	320	240
£16	420	360	300
£20	432	384	336

vary with an increase in the number of consumers using the service and with an increased use made by each consumer. Thus the standing cost is a constantly varying one, assuming continual progress in electrical development.

When electric cookers are generally used it may reasonably be assumed that the maximum demand of an undertaking (where the domestic load preponderates) will occur at some time outside the lighting hours, and consequently the fixed charge per consumer will have to be based on the maximum demand created by cooking load—an infinitely larger figure, after allowing for diversity, than that due to lighting, entailing the alteration of the whole tariff.

Many chief engineers look askance at electric heating as they fear that a cold spell at an inopportune time will raise their fixed-charge component above the revenue obtained from that particular service. The Central Electricity Board has decided to charge only on the maximum demand created during the four winter months. Is it possible to go a step further and charge on the average of a number of maximum demands for the above-mentioned period instead of on one figure only?

Suggested Two-rate Tariff

The economics of electricity supply irrefutably involves a high cost over maximum-demand periods and the period during which the high cost obtains will vary with the advance and extension of the use of electricity. Is there any reason to prevent the charges being fixed on a time basis? That is, ignore the purpose for which current is being used but vary the charge with the time of use. A simple two-rate meter would meet the case. The periods during which the high and low rates are in force could be varied from time to time and as the characteristics of the load altered.

TABLE 3.
Cost in pence per kWh.

Annual expenditure.	Fixed charge.		
	£2.	£4.	£6.
£4	1.0	—	—
£8	0.6667	1.0	2.0
£12	0.6	0.75	1.0
£16	0.5714	0.667	0.8
£20	0.5555	0.6248	0.7153

This method of charge would encourage use during off-peak hours and would ensure that the cost per kWh to the consumer varies in direct ratio with the use made of the service during load hours. Above all, it has the merit of being understandable.

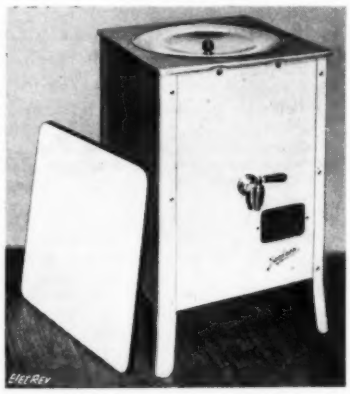
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Square Wash-boiler

A square 10-gal. wash-boiler that can also serve as an extra table is a new product of the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1.

The outer steel case is finished in mottled grey vitreous enamel, the legs, which are formed by the extension of the reinforced corner strips, being similarly finished. The interior is circular in shape and, in addition to a square lid forming the table top, has an inner circular lid. Heavy gauge copper, tinned inside, is used for this inner lid and also for the container; the rapid emptying tap is chromium plated with an insulated handle. The apparatus is 30 in. high, 20 in. wide and 22½ in. deep.



The latest Jackson wash-boiler

Elements of the "Chromalox" type (loading, 3.4 kW) are fixed to the underside of the container and are controlled by two foot-press switches let into the side of the boiler. A "Perco-Wash" sprayer and an automatic cut-out can be fitted at a slight extra cost.

Siemens Instruments

Instruments marketed in this country by SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., 30, New Bridge Street, London, E.C.4, include two noise meters of the objective type, each designed for specialised fields of application.

The general purpose model, in a carrying case, has a range from 25 to 120 phons while the range of the traffic and aircraft box type is from 50 to 115 phons.

Desk galvanometers, ammeters and voltmeters in moulded insulated housings are offered with a shadow pointer in place of a moving needle. A small mirror attached to the moving element, suspended by two tension wires, reflects a spot of light from a 2.4-W, 4-V battery lamp on to the deflection scale, thus showing an image of a fixed pointer. In this way parallax errors are minimised and the inertia of the moving element is reduced, thereby increasing sensitivity to small variations of current. Levelling or other adjustment prior to use is not necessary.

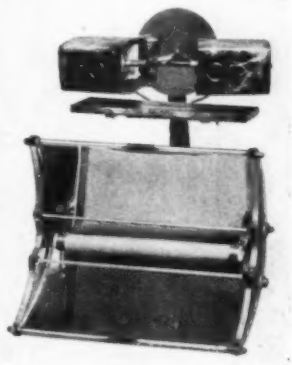
For measuring signal level and residual attenuation in long telephone lines there is an outfit in two sections. The transmitter comprises a beat oscillator, the frequency of which is changed by a clockwork-driven variable condenser, in association with a power amplifier and voltage-measuring equipment. The audio-frequency power fed into the line is received by a combined indicator and recorder, whose clockwork is tripped at the correct instant by a timing signal sent out shortly before transmission starts. The clockwork at the transmitting and receiving ends operates at the same speed, the time needed for sending out the test frequencies being about two minutes; but the recording time can be increased fourfold for measurements on lines with large level variations in close sequence. The frequency range of the outfit extends from 30 to 10,000 cycles. The apparatus complies with the C.C.I. recommendations, and the receiver may be portable or rack-mounted for permanent installation.

For testing radio receivers there is a high-frequency oscillator with a range of 100 to 21,000 cycles, corresponding to wavelengths of from 3,000 to 14 m. The frequency can be adjusted with an accuracy of ±1 per cent. with the aid of a calibration curve, and a potential divider enables the voltage to be adjusted from 10 μV to 100 mV as well as 1 V. Audio-frequency modulation takes place at a fixed frequency of 400 cycles, but provision is made for separate modulation at from 50 to 6,000 cycles.

The modulation tone may be heard on the loudspeaker of the set under test, or it may be indicated by an audio-frequency combined voltmeter and ammeter in a carrying case. This portable instrument utilises a copper-oxide rectifier; it is independent of frequency between 40 and 10,000 cycles, and has twelve measuring ranges, range extension being effected by a combination of calibrated shunt and series resistances which can be changed over by a rotary switch. The accuracy is within three per cent. at 20 deg. C., and the consumption is from 0.2 to 1.1 mA, according to the position of the range switch.

An Ultra-violet Lamp and Fire

An interesting appliance made by the ARORA CO., Loughborough, is a combined fire and ultra-violet ray lamp. The lower portion is a standard Arora fire, above which tungsten-cored carbon electrodes in front of a small reflector serve to produce the ultra-violet rays. Pure tungsten electrodes can be employed, giving more intense rays.



The Arora ultra-violet lamp and fire

A Thermostatically Controlled Hair Dryer

A thermostat which enables the temperature to be set at any level between 100 and 200 deg. F is an additional improvement now incorporated in the "Thermo-plus" hair dryer produced by the DEXTER MANUFACTURING CO., LTD., 22-23, Dean Street, London, W.1. It is claimed that this improvement enables the electricity consumption to be halved.

An Illuminated Floral Decoration

A striking fitting of unusual but very attractive design, to which our attention has recently been drawn, is an illuminated floral decoration known as the "Floralite." This development is a new product of the BRITISH ELECTRICAL & MANUFACTURING CO., 13, Charlotte Street, London, W.1.

It consists of a lifelike metal basket of flowers, each bloom concealing a miniature electric lamp. The flowers are also available in vases and are interchangeable, and the lamps are operated off the mains through a transformer. The fitting is also adaptable for use in cornices and around pillars, while it can equally well be incorporated in special fittings for large displays.

The "Floralite"

A Universal Radio Receiver

The radio department of PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2, has sent us details of the company's only new mid-season model. It is a four-valve (plus rectifier) universal superinductance broadcast receiver, including such special features as a "Droitwich filter" and automatic current control by means of a barretter. The arrangement of the valve stages is pentode h.f., pentode detector and an 8-W pentode output. Both the automatic volume control and the manually operated volume control, which also forms the on-off switch, are in the high-frequency stage.

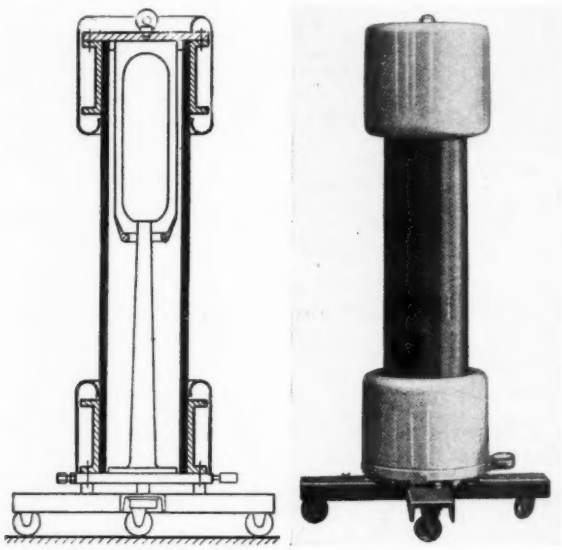
Compressed-gas H.V. Condensers

The electrical strength of a gas increases as the pressure from 1 to 15 atm. In nitrogen, for example, flash-over between flat plates 1 cm. apart occurs at 20 kV at 1 atm., and at 200 kV at 10 atm., showing electrical strength which is superior to that of the best transformer oils and which is not decreased by flash-overs. Pure gases have no dielectric losses, and are thus especially valuable for high-voltage comparison condensers for making accurate measurements of dielectric losses in cables, insulators and condensers, with the "Schering" bridge, as these must be loss-free.

These condensers can be designed as air condensers for low voltages; to limit the dimensions at higher voltages, however, compressed gases have been successfully employed. On the earthed base, an insulation tube is secured by a strong flange; at the upper end of the tube a flange and cover plate make it gas-tight, so that the insulation tube also acts as the gas container. The gas pressure can be constantly checked by a gauge on the base of the condenser.

The measuring condenser consists of two concentric cylinders. The internal coating, which is the measuring conductor, is

mounted insulated on a narrow column standing on the bottom cover plate, and runs through the gas-tight column to the outside. The outer conductor is fitted on the top cover plate and is connected to the high-voltage supply. To avoid corona the metal parts at both ends of the insulation tube are covered with rounded-off sheet metal. At the top is an eyebolt for



Diagrammatical and external views of the conductor

lifting the apparatus while the gas inlet and outlet and also the terminal for the measuring connections are provided at the other end.

Messrs. Hartmann & Braun are the manufacturers of these precision condensers for test voltages up to 550 kV, which may be obtained from the KANDEM ELECTRICAL, LTD., 711, Fulham Road, London, S.W.6.

Glass Pendants for Low Ceilings

Several new types of glass chandelier fittings specially designed for the lighting of modern houses and flats with low ceilings are now available from MESSRS. AVERY, WARD & CO., who have recently been appointed sole agents in Great Britain for the glassware made by Messrs. Adolf Schonbek, of Morchenstern.

An Avery, Ward chandelier fitting

The model which we illustrate has overall measurements of 19 in. and 15 in. and has provision for five candle lamps. Among many other examples of illuminating glassware, which are to be seen at the company's showrooms at 16, Fitzroy Street, London, W.1, are nearly a hundred different patterns of cut crystal glass table standards.

Machinery "Stethoscopes"

Improved "Bin-Aural" apparatus designed for the testing of the internal condition of machinery is being marketed by the CAPAC CO., LTD., 26, Brookwood Avenue, Barnes, S.W.13. There are three reproducers in the equipment; two of these are in the form of test rods and are termed "Testoscopes." They are screwed to the head-frame connecting tube and held in firm contact with the part under test. By this method the internal sounds may be heard. For listening to external sounds a conical mouthpiece known as a "Testophone" is fitted. Comparisons can be made between two internal sounds or between noises inside and outside the machinery.

An Automatically Lighted Alarm Clock

A synchronous electric alarm clock, arranged for automatic lighting of the dial, has been produced by MESSRS. FERRANTI, LTD., Hollinwood. It is provided with a small glass panel (4) at the base of the dial (3). Below this is a 3.5-V lamp which shines through a slot in the bezel, and through the opal glass panel, giving a diffused glow to the dial. The driving motor and train are as used for the earlier models, and the alarm mechanism and illumination device have been built around these with very little need for modifications in design. The energy for the lamp is obtained from a secondary winding over the clock coil (1) on the stator, while the lamp (2) is mounted in a sliding holder (13) which can be removed without the disconnection of any wiring.

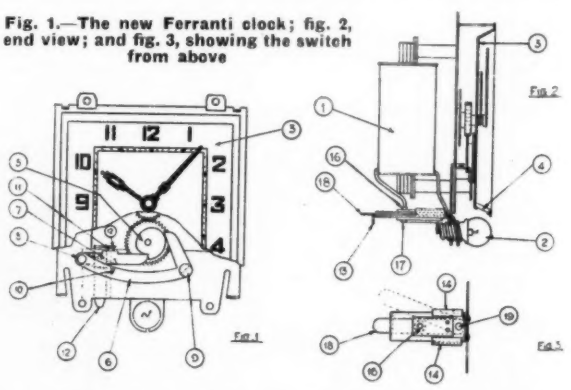
The automatic switching is arranged to light the lamp at midnight and to extinguish it at 8 a.m. Advantage has been taken of the 24-hour spindle controlling the alarm release to obtain this switching. A cam (5) is mounted on the 24-hour spindle with the drop edge in a set position in relation to the clock hands. Bearing on the cam face is one end of a bell-crank lever (6) pivoted to the clock frame at (9). The opposite end of this lever has another straight lever (7) pivoted to it at (8), and this second lever also bears on the cam. A U-shaped spring (10) is looped around the pivot point of the straight lever and tends to thrust the levers apart, in this way retaining them in contact with the cam face.

When the straight lever (7) drops off the step of the cam it makes contact at (11) with a stud (12) mounted on an insulating base in the clock frame. One of the leads from the secondary, or lamp, winding of the clock coil is connected to this pin, and the contact of the lever completes the circuit.

During the eight hours which the lamp is alight the cam turns through 120 deg., the levers remaining stationary. At the end of the period the bell-crank lever drops off the cam step and moves the pivot point of the straight lever to a point which causes this lever to break contact with the pin. This extinguishes the lamp until the next midnight. A hand switch (18) to cut out the lamp when it is not required is also fitted. It consists of a pivoted strip of insulating material which can be moved in a horizontal direction to pass between two contact points (16) and (17) included in the lamp circuit. It is operated from the rear of the clock. To change the lamp it is only necessary to remove the back of the clock and pull the holder straight out.

The alarm mechanism is a vibrating tongue spanning the poles of the stator, which is simply released mechanically at the set time to vibrate until silenced by the depression

Fig. 1.—The new Ferranti clock; fig. 2, end view; and fig. 3, showing the switch from above



of a knob on the top of the case. The alarm is automatically released to sound again 24 hours later by the action of the release cam itself, but it can be silenced completely by depressing and turning the silencing knob.

Silvered-interior Lamps

A large saving in lighting costs is claimed to be effected by the use of the "Alba" gas-filled lamp, which is constructed with the top half of the interior silvered. No outside reflectors are necessary, and the silvering is not liable to tarnish as is often the case in lamps with an exterior coating. Both plain and corrugated types are available, the lower halves being of either clear or pearl glass. They are made in all standard voltages and wattages, with either bayonet or screw fitting, and the price is only slightly above that of ordinary gasfilled lamps.

The "Alba" lamp

The lamps, which have tungsten filaments and are guaranteed for 1,000 hours, are suitable for use in any position where increased downward illumination is required, such as in shop windows, offices, laboratories, factories, hospitals and garages, as well as in the home. At present they are manufactured in Belgium, but the suppliers, the ALBA LAMP CO., Craven House, Kingsway, London, W.C.2, hopes to start manufacturing them in this country in the near future.

United Kingdom Electrical Exports

And the markets to which they go

WITH the publication by the Stationery Office of Vol. III of the annual statement of the trade of the United Kingdom for 1934 particulars are now made available of the exports of electrical machinery and apparatus to the chief countries of destination and with a classification much more detailed than that adopted in the monthly returns. From this statement the following figures have been taken. At the same time, a comparison is given of the increase or decrease as compared with the preceding year. As new headings were adopted in 1934 for paper-insulated telegraph and telephone wires and cables and fractional-horse-power motors, comparisons in those cases are not possible. The grand total of the machinery group, while showing an increase of £640,000 on the year, is £370,000 below the level of 1932, when foreign countries were much bigger buyers than they are now. In 1934 British countries bought £735,000 more electrical machinery from the United Kingdom than in 1933 and £485,000 more than in 1922. In the electrical goods and appliances group British countries also were outstanding customers (South Africa notably so), the total for 1934 being £5,059,000 out of an aggregate to all destinations of £8,033,000. At the same time, there was a small increase (£199,000) to foreign countries, the total being £2,974,000, as compared with £2,775,000 in 1933. But in this group figures are far below those of 1931 and former years.

	1934. £(000).	Inc. or Dec. £(000).
Generators, above 200 kW.—		
Total	443	+ 105
To Soviet Union	3	− 63
„ Denmark	—	− 36
„ China	74	+ 70
„ S. Africa	172	+ 95
„ India	54	+ 12
„ Australia	24	− 13
„ Canada	16	− 2
Generators, not above 200 kW.—		
Total	207	+ 34
To Iraq	2	− 10
„ Spain	7	− 2
„ S. Africa	21	+ 10
„ India	55	+ 16
„ Australia	22	+ 10
„ Canada	4	+ 1
Motors, Traction—		
Total	40	− 4
To Brazil	5	− 4
„ Uruguay	6	− 8
„ Hungary	8	+ 3
„ India	4	− 2
Other motors above 250 h.p.—		
Total	328	+ 74
To Soviet Union	14	− 138
„ Hungary	115	+ 113
„ S. Africa	158	+ 107
„ India	13	+ 2
„ Australia	10	− 4
Other motors from 1–250 h.p.—		
Total	540	*
To Soviet Union	3	*
„ China	26	*
„ Brazil	9	*
„ Argentina	8	*
„ Irish Free State	13	*
„ S. Africa	103	*
„ India	106	*
„ Australia	52	*
Other motors not exceeding 1 h.p.—		
Total	79	*
To Germany	10	*
„ France	13	*
„ Australia	7	*
Rotary convertors—		
Total	62	+ 11
S. Africa	11	− 3
„ India	10	− 5
„ Australia	3	+ 2
„ New Zealand	2	+ 1
Static transformers—		
Total	363	+ 115
To Egypt	1	− 8
„ China	11	+ 3
„ Mexico	10	+ 5
„ Brazil	6	+ 3
„ Argentina	1	− 5
„ Palestine	19	+ 5
„ S. Africa	135	+ 58
„ India	75	+ 11
„ Malaya	12	+ 2
„ Australia	10	+ 8
„ New Zealand	25	+ 11
Starting and control gear for motors—		
Total	313	+ 59
To Soviet Union	4	− 37
„ Hungary	18	+ 16
„ Egypt	10	+ 2
„ China	11	− 2
„ Argentina	4	− 3
„ S. Africa	100	+ 63
„ British India	46	+ 9
„ Australia	9	+ 2
„ New Zealand	8	− 27
Other switchgear—		
Total	789	+ 155
To Soviet Union	—	− 21
„ Egypt	11	− 8
„ China	28	+ 9
„ Argentina	6	− 14
„ S. Africa	268	+ 55
„ India	234	+ 75
„ Australia	52	+ 9
Elec. machinery not elsewhere specified—		
Total	113	− 28
To Sweden	16	+ 7
„ Germany	7	+ 1
„ Holland	3	—
„ Belgium	5	− 2
„ France	16	− 2
„ Switzerland	13	+ 1
„ Italy	10	+ 2
„ Brazil	3	+ 1
„ Argentina	2	− 1
„ Irish Free State	1	− 4
„ S. Africa	1	− 6
„ British India	6	− 13
„ Australia	5	− 1
„ New Zealand	2	—

	1934. £(000).	Inc. or Dec. £(000).
Wires and cables, rubber-insulated, not telegraph or telephone—		
Total	870	+ 170
To China	26	+ 6
„ Argentina	14	+ 2
„ S. Africa	204	+ 42
„ India	190	+ 23
„ Malaya	28	+ 13
„ Australia	212	+ 63
„ New Zealand	44	+ 11
Wires and cables, insulation other than rubber, not telegraph or telephone—		
Total	306	− 216
To China	7	− 9
„ Argentina	14	+ 5
„ S. Africa	28	− 125
„ India	75	− 50
„ Malaya	10	− 6
„ Australia	75	− 14
„ New Zealand	12	+ 2
Telegraph and telephone cables (not submarine)—		
Total	376	+ 112
To Portugal	8	− 4
„ Rumania	3	− 10
„ Egypt	22	+ 10
„ China	5	− 13
„ Brazil	22	+ 17
„ Mexico	—	− 23
„ Argentina	39	+ 31
„ S. Africa	96	+ 34
„ India	26	+ 5
„ Malaya	14	+ 10
„ Australia	54	+ 25
„ New Zealand	18	+ 4
Submarine telegraph and telephone cables—		
Total	79	− 50
To Denmark	16	− 32
„ France	14	− 23
„ United States	20	+ 14
„ New Zealand	5	+ 1
Telegraph and telephone wires and cables, paper insulated—		
Total	527	*
To S. Africa	203	*
„ India	133	*
„ Australia	65	*
„ Argentina	22	*
Wireless receiving sets, other than radio-gramophones, excluding valves—		
Total	325	+ 84
To Holland	54	+ 20
„ Belgium	33	+ 5
„ Irish Free State	67	+ 16
„ S. Africa	22	+ 8
„ India	6	− 1
„ New Zealand	17	+ 6
Wireless transmitting apparatus, excluding valves—		
Total	273	+ 9
To Portugal	17	− 3
„ Italy	—	− 23
„ Rumania	106	+ 23
„ China	40	+ 13
„ Brazil	16	+ 11
„ South Africa	7	− 4
„ India	3	+ 1
„ Australia	13	+ 10
Wireless valves—		
Total	376	+ 22
To Sweden	44	+ 22
„ Belgium	40	+ 12
„ France	15	− 27
„ Switzerland	7	− 4
„ Czechoslovakia	6	− 7
„ Irish Free State	43	+ 10
„ South Africa	16	+ 3
„ India	10	− 2
„ Australia	34	+ 8
„ New Zealand	10	+ 3
Other wireless parts and accessories—		
Total	513	+ 116
To Norway	7	− 4
„ Denmark	9	− 2
„ Holland	121	+ 57
„ Belgium	23	—
„ France	22	+ 7
„ Italy	8	− 5
„ Rumania	12	+ 1
„ Irish Free State	37	+ 4
„ S. Africa	22	+ 6
„ India	24	+ 2
„ Australia	19	+ 8
„ New Zealand	22	− 3
Unspecified telegraph and telephone apparatus other than wireless—		
Total	1,107	+ 33
To Sweden	32	+ 4
„ Poland	40	− 89
„ Portugal	34	− 36

	1934. £(000).	Inc. or Dec. £(000).
Unspecified telegraph and telephone apparatus other than wireless—(continued.)		
„ Egypt	47	+ 2
„ Brazil	14	− 24
„ South Africa	252	+ 34
„ India	79	+ 25
„ Australia	150	+ 94
Electric carbons—		
Total	58	+ 24
To British countries	29	+ 17
Electric lamps, 20 V and over, gasfilled—		
Total	332	+ 78
To Argentina	21	+ 3
„ Irish Free State	24	—
„ S. Africa	66	+ 21
„ India	47	+ 7
„ Australia	60	+ 28
„ New Zealand	49	+ 11
Electric lamps, 20 V and over, other than gasfilled—		
Total	135	− 8
To South Africa	23	− 8
„ India	27	+ 1
„ Australia	10	+ 4
„ New Zealand	20	− 5
Electric lamps under 20 V, for flash lamps—		
Total	13	+ 3
To British countries	13	+ 4
Electric lamps under 20 V, other than for flash lamps—		
Total	28	+ 8
To British countries	26	+ 8
Unspecified lighting appliances—		
Total	358	+ 81
To Irish Free State	19	− 1
„ South Africa	85	+ 33
„ India	87	+ 21
„ Australia	37	+ 9
Primary batteries for hand flash lamps—		
Total	22	− 20
To British countries	16	− 15
Other primary batteries—		
Total	170	+ 6
To Irish Free State	21	− 2
„ South Africa	26	+ 1
„ New Zealand	12	− 1
Portable accumulators—		
Total	300	+ 50
To Denmark	30	+ 9
„ Holland	27	+ 10
„ Irish Free State	28	+ 8
„ South Africa	15	—
„ India	62	+ 4
Stationary accumulators—		
Total	225	− 42
To Holland	4	− 8
„ Belgium	5	− 6
„ Greece	10	− 7
„ India	38	− 10
„ Hong Kong	5	− 48
„ New Zealand	7	—
„ Australia	4	+ 2
Elec. cooking and heating apparatus—		
Total	186	+ 49
„ South Africa	70	+ 15
„ New Zealand	26	+ 14
Elecl. instruments (other than telegraph and telephone)—commercial—		
Total	108	+ 17
To India	24	+ 2
„ Australia	17	+ 3
House service meters—		
Total	130	+ 22
To South Africa	23	+ 7
„ India	34	+ 3
Electro-medical apparatus—		
Total	37	+ 5
Permanent magnets—		
Total	36	+ 4
Insulating materials—		
Total	107	+ 29
To British countries	58	+ 17
Elec. goods and appliances, not elsewhere specified—		
Total	867	+ 151
To Denmark	32	− 40
„ Holland	28	+ 16
„ Belgium	17	+ 2
„ France	34	+ 6
„ Switzerland	13	− 2
„ Italy	74	+ 3
„ Argentina	20	+ 2
„ Irish Free State	44	+ 9
„ South Africa	136	+ 63
„ India	126	+ 25
„ Malaya	17	+ 6
„ Australia	39	− 7
„ New Zealand	36	+ 13

* Comparative figures not available.

New Customs Regulations. By John C. Hancock

The importance of correct information

ONE of the new regulations brought into force by the Commissioners of Customs and Excise at the beginning of the New Year is that in future it will be necessary to show on all customs entries—for shipments both outwards and inwards—the nationality of the vessel carrying the goods. Inquiries at the Board of Trade and H.M. Customs and Excise have failed to elicit a reason for this new regulation, but in well-informed circles it is believed to be not unconnected with certain inquiries into the desirability or otherwise of an extension of the shipping subsidy. That remains to be seen. In the meantime, however, the electrical trader or manufacturer must furnish this information in addition to the other particulars hitherto required on all outward and inward shipments.

The exporter is required by law, within six days after the final clearance outwards of the exporting ship, either personally or through an agent, to lodge a specification on the appropriate form. For goods other than textiles and goods exported under drawback, Form No. 29B (Sale) should be used, and the exports should be described in accordance with the descriptions set out in the "Import and Export List." Incidentally it is worth noting that it is not necessary to fill in the space reserved for the total value; this has been the case for years, yet for some unknown reason there is still a space left for that purpose. Many valuable hours per annum must be lost by shippers who religiously total their shipping specifications, while any Customs official will admit that the total is invariably ignored.

There is, however, a tendency among many manufacturers to underrate the importance of furnishing correct information on their specifications. While it may not appear to the individual manufacturer of great importance in passing a single error or supplying wrong information, it will readily be seen that the cumulative effect of such errors and omissions means that the trade returns of the country are not accurate. If the manufacturer would realise that the export figures—happily on the up grade once again—which appear from time to time in the ELECTRICAL REVIEW are supplied by the manufacturer himself, it is probable that he would instruct his clerks or agent in the importance of this branch of shipping.

Trade Statistics

These trade returns are of great value to this country. The figures are the basis on which trade agreements with foreign states are negotiated and for the regulation of quotas and import restrictions. They are also useful to the manufacturing community in general.

For a small fee any trade organisation or manufacturer can obtain figures in greater detail than are contained in the monthly "Accounts Relating to the Trade and Navigation of the United Kingdom" published by H.M. Stationery Office. If these figures are to be of any value they must be accurate, and they cannot be accurate without the co-operation of every exporter.

It is recorded that the representative of a large group of manufacturers indignantly disputed a set of figures supplied by the Statistical Office of H.M. Customs and Excise. By a strange paradox, it transpired that the industrial group which he represented had actually been to a large extent responsible for the discrepancy in the disputed figures. Obviously it is quite impossible for the Customs authorities to check each item on a specification.

For long it has been a rule that exporters may be called upon to verify the particulars given, by the production of invoices, bills of lading, etc., in respect of goods shown on a specification. In the past this rule has not been very rigorously applied. Quite recently, however, a special "test" department has been instituted at the Statistical Office of the Customs and Excise. At intervals—not necessarily regular ones—each exporter will be requested to produce, if not for an inquisition, then for an inspection, all documents relating to a certain shipment. In this way it is hoped to achieve a greater degree of accuracy in the trade returns of the country.

It is now necessary to show the port or place of foreign loading, in addition to the name of the place to which the goods are consigned and the country of origin, on all entries inwards. This information must be given on "free" entries as well as an "dutiable" entries. It is not permissible, by the way, to continue using the old forms unless special arrangements have been made with the Customs authorities. Unless one has a very large stock of obsolete forms on hand it is hardly worth while going to this trouble.

"Post Landing Charges"

Another regulation imposed upon the importer relates to the value of the goods (*i.e.*, goods liable to any *ad valorem* duty) for duty purposes. Previously, when goods were imported by steamer it had been necessary to show merely the full c.i.f. value plus port rates, etc. Like all seemingly irksome restrictions this regulation has been designed to check an abuse. Many forwarding agents, by manipulating the shipping charges, evaded paying duty on the full c.i.f. value. When a through rate had been quoted on goods bought "ex works" the extra-keen agent would declare on behalf of his client, or the actual importer, a fictitiously low freight figure and call the balance "post landing charges." To curb this evasion of duty the Customs authorities laid down the rule that all post landing charges (*e.g.*, landing, wharfage, etc.), in excess of a certain figure, should be added to the value of the goods liable to *ad valorem* duty.

Standard rates, for London, are to be found in the "Schedule of Quay Delivery Rates" published by the Port of London Authority. When the charges per ton for landing and wharfage, etc., equal or do not exceed the "Quay Delivery Rates" as published, the actual charges need not be taken into account for duty.

Apart from the fact that the country was being defrauded of considerable sums of money, the honest trader was penalised in having to pay not only the correct amount of duty, but somewhat more than his not-so-honest contemporary. Such a practice as this explains to a large extent the strictness necessary on the part of the authorities with regard to the importation of dutiable goods. There are always some people willing to risk a severe fine to save a few shillings in Customs duties. Consequently the honest trader has to submit to all kinds of irritating restrictions through no fault of his own.

In the Courts

AT Camborne on January 7th Messrs. Carkeek & Sons, Ltd., contractors, Plymouth, were summoned for having failed to comply with the Electrical Regulations under the Factory and Workshops Act "in that on certain portable apparatus, namely, an electric lighting fitting, the metal work was not efficiently earthed and the lampholder was in metallic connection with other metal work of the lamp, in consequence of which negligence one Bert Allen was killed."

Mr. W. J. K. Cook, H.M. District Inspector of Factories, who prosecuted for the Home Office, said that at the time of the alleged offences the defendant firm was engaged in the erection of a new cinema at Redruth, and had installed a temporary electric lighting set for the purpose of providing illumination for the workmen. Attached to the set were a number of portable electric flood lamps, which were moved from point to point as required. It was alleged that Allen caught hold of the steel tubular scaffolding which had been rendered alive by contact with one of the portable lamps and received a shock which caused him to fall, with fatal results. The prosecution alleged that the scaffolding was made alive through a defect in the lamp, which was resting on a platform at the top of the scaffolding, examination establishing that the metal lampholder, which was broken, was in metallic contact with the rest of the fitting and that no earthing was provided.

Samuel Job, a foreman in the employment of the defendants, said, in answer to Mr. E. A. Thrall, for the defence, that prior to the accident both he and other workmen had used the lamp in question and none of them had felt any shock. Dr. McDonald, of Redruth, said that he examined the deceased, whose death was due to electric shock.

Horace P. Davis, a foreman electrical engineer, said that after the accident he found that the scaffolding was alive. He traced the cause to the lamp in question, which was resting against part of the scaffolding. The insulating ring was missing from the holder; no means were provided for earthing the lamp. Mr. J. T. Dunn, H.M. Inspector of Factories, said that when he visited the cinema after the accident he could see no means of earthing the external metal parts of the lamp. The holder was in metallic connection with the reflector, and in that respect did not comply with the regulations. Mr. H. C. Frampton, H.M. Electrical Inspector of Factories, said that if the lamp had been earthed the workman would not have received a shock even if the insulator had been broken.

Mr. Thrall submitted that the Act did not apply to the construction of the cinema because nothing was being manufactured there and because there was no working machinery on the premises, but this submission was overruled.

William H. Coles, of Connor Down, manager of the Cornwall branch of the defendant firm, said that the temporary lighting installation had never failed prior to the accident. The lamps were used at Padstow for three and a half years in connection with pile driving, which was a very severe test.

After further evidence Mr. Thrall pointed out that this particular lamp had been used again and again without mishap. It was admitted that it was not efficiently earthed, but he sug-

gested that insulation in certain circumstances was at least as effectual as earthing, and possibly more so. Hundreds of pieces of apparatus were in use in which reliance was placed on two-core flex.

The magistrates found the case proved and imposed a fine of £10.

An Unlicensed Radio Transmitter

The Times reports that at Brighton on January 13th George Skinner, of Brighton, a young labourer, who built a wireless transmitting set from a second-hand blueprint and then broadcast mouth-organ music, was fined 20s. for not having a transmitting licence. Skinner told the Court that he built the set from parts which he already had, but he did not think it carried beyond the house. He did not know that he required a transmitting licence.

Waste Heat and Gas Co.'s Capital Reduced

In the Chancery Division on January 13th Mr. Justice Crossman had before him a petition by the Waste Heat & Gas Electrical Generating Stations, Ltd., for the reduction of its capital, to be effected by the return to the shareholders of capital in excess of the company's requirements.

Mr. Cecil Turner, for the company, said that it was proposed by the petition to return 10s. per share to the holders of the 320,000 issued £1 shares—a sum of £160,000. The 30,000 unissued shares would be divided into 10s. shares and power was taken to increase the capital back to the original amount by the creation of further 10s. shares.

The company was formed in 1907 as an electric power supply company and erected six stations. Owing to modern developments in the electrical world the company entered into an agreement in 1922 to realise its stations, spread over a period of fifteen years, and there was only one year of that agreement to run and one station to be handed over. The company had received very large sums for its stations and had accumulated large profits from investments, and the amount now received was in excess of its wants and could not be utilised in its business.

In the result his Lordship granted the reduction of the company's capital as asked.

New Books

Mercury-Arc Current Convertors. By H. RISSIK. Pp. 424; figs. 233. London: Sir Isaac Pitman & Sons, Ltd. Price 21s. net.

While, as the author points out in the opening chapter of his book, the physical principles underlying the behaviour of the mercury-arc rectifier are not new in quite the same sense that power arc rectifiers of to-day may so be termed, the truly commercial developments and applications of the latter are essentially of the post-war period, and therefore bring this class of plant into the sphere of modern electrotechnology.

The general lack of precise knowledge of the principles and practice of this important branch of engineering is, no doubt, due largely to the essential transition stage between theory and practice, and also to the absence of authoritative books on the subject prepared in such a way that the non-specialist engineer can grasp readily and thoroughly the underlying principles and gain a good working knowledge of the mechanism. Within recent years several excellent works on arc-rectification have appeared, but these, with hardly an exception, have not provided just the requisite treatment to fill the newly created gap in the keen but busy engineer's technical education. The present publication, however, meets the situation in a most able and attractive manner. The book is divided into two major parts, which deal respectively with the principles and mechanism of rectification and of current conversion.

In the first part the author guides us from the early days of mercury-arc rectifiers to modern equipments suitable for arduous duties on large power networks and important traction systems; this by way of three particularly good chapters on rectifier-circuit theory.

In the second part the subject matter is more varied as, perhaps, the section demands; it is concerned chiefly with the applications of theoretical principles to commercial designs. The chapters of outstanding merit are those dealing with grid control, the mercury-arc invertor (d.c. to a.c.), the mercury-arc cycloconvertor (static-frequency convertor), generation of harmonics and calculation of rectifier-circuit data. The final chapter describes and illustrates some typical British rectifier installations, both glass-bulb and steel-tank types, for traction and industrial services. Mathematics has been reduced to a minimum, and, where included, presents no difficulty to the interested reader. The illustrations have been prepared most carefully, and the printing and format are excellent. This book is eminently qualified to become the standard introductory work on the subject.

Practical Cable Jointing. (Second edition.) Pp. xii+301; 442 figs. London: W. T. Henley's Telegraph Works Co., Ltd. Price 5s. net.

When the first edition of this manual appeared about two and a half years ago we hailed it as being the most practical and explicit work of its kind which we had seen. The second edition has been made even more serviceable by the addition of sections on the impregnation of copper tape; the repair of trailing cables; the correct use of joint box compounds; the jointing of overground disconnecting boxes and distribution panels; the jointing of narrow type underground distribution boxes; and the connecting-up of varnished cambric cables. We may say again that the book is wonderful value for the money.

Le Champ Electromagnétique. By MARC JOUGUET. Pp. 220; figs. 20. Paris: Librairie Armand Colin. Price Fr.10.50.

This book may be recommended confidently to anyone desiring a concise presentation of the theory of electrical and magnetic fields. The experimental aspect is not considered. The treatment is purely mathematical, and the reader is assumed to be thoroughly conversant with the terms and principles of electricity and magnetism and familiar with vectorial and calculus mathematics. On these lines an analytical treatment of facts and theoretical conceptions is based on the fundamental principles expressed by Maxwell's equations. In an introductory note the author emphasises the essential part played by matter in the phenomena of electrical equilibrium. The principles of electrostatics can, however, be established by considering charges independent of matter and then proceeding to the examination of the influence of conductors and dielectrics on the distribution of charges.

Thus, the first part of the book deals with the general properties and fundamental equations of the electrostatic field, the electrical equilibrium of conductors, and the conditions in dielectrics. The second part deals successively with the laws of continuous-current flow, the magnetic field of current-carrying conductors, the corresponding mechanical forces, and the action of magnets and magnetic media. Then follows a treatment of systems in which the conditions are variable with time, the laws and equations of the electromagnetic field, the consequences and applications of these laws, and the modifications introduced by dielectric and magnetic media. Finally, the author demonstrates the simplified conception of electromagnetic phenomena resulting from the principle of relativity.

Television Up-to-date. By R. W. HUTCHINSON. Pp. 180; illus. 125. London: University Tutorial Press, Ltd. Price 2s. 6d. net.

The author of this excellent little book is not only thoroughly conversant with this intricate subject but can make his description clear, concise and interesting throughout. He tells to-day's story of television with a smooth and even flow that in its course marshals the many scientific facts into their natural order and makes the book eminently suitable even for the general reader with more than a passing interest in this subject.

To the discerning reader the author, in more than one instance, points a moral and thus still further adorns his tale and surprises us with some of the controversial issues raised. On page 20 he says: "If a stone is dropped into a smooth pond, waves travel outwards in concentric circles, ... a cork floating bobs up and down with each wave *but is not carried along*" (the italics are ours). What is the author's explanation of the schoolboy's success in retrieving his cork ball when, by dropping stones into the water a short distance behind it, he causes a progressive movement of the ball in his direction?

The many diagrams in this book deserve high praise, particularly since they cover the principal systems that at present show definite promise. Now that a systematic television service is about to start in England this little book should have a wide sale and find its way to the bookshelves of all who are interested in the subject, for it offers splendid value at a modest price.

Organisation and Administration of Industry. By F. T. LLOYD-DODD, M.A., D.Sc., and H. J. LYNCH, Ph.D., B.Sc. Pp. 32+501. London: Sir Isaac Pitman & Sons, Ltd. Price 15s. net.

The authors of this work claim that "the main principles underlying the functions of modern industry may be reduced in form to scientific laws." These principles are dealt with at length, but due attention is given to practice, particularly in the last of the three sections into which the book is divided. A vast amount of ground is covered in showing the gradual growth of the modern industrial system and the factors which have influenced that growth; in studying the general relationship between industry and the economic world as a whole; and in dealing with the practical organisation of industry, including such matters as factory lay-out, wages and efficiency, production and research.

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Shorter Notices

"Private House Electric Lighting." By F. H. Taylor. Fourteenth edition. London: Percival Marshall & Co., Ltd. 1s. 6d. net.—This edition has been revised to conform with the new I.E.E. Regulations, and with further advances in the practice of electrical installation work. A chapter has been included on the installation of domestic electrical appliances.

"Electric Arc Welding Practice," by H. J. Lewenz. Pp. 126; figs. 103. London: Crosby Lockwood & Son, Ltd. Price 8s. 6d. net.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The " Electrical Review " Index

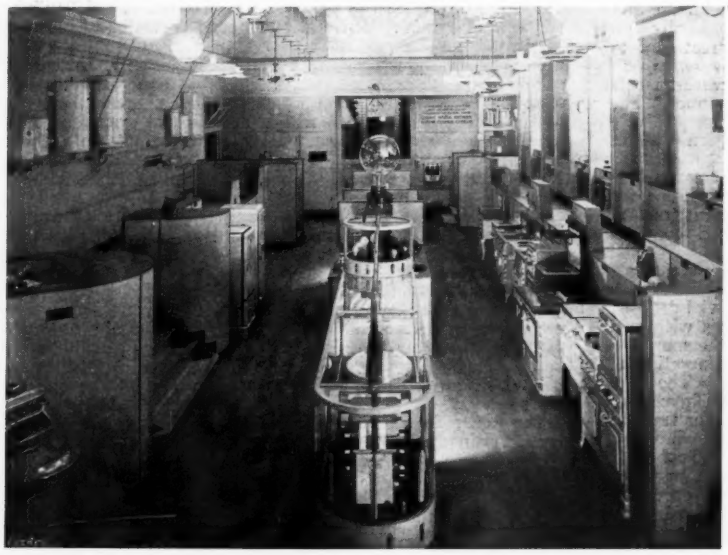
The index to Vol. CXVII (for the half-year ended December 31st, 1935) is now being printed. We shall be glad to receive the names and addresses of readers who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, ELECTRICAL REVIEW, Dorset House, Stamford Street, S.E.1.

British Industries Fair

Since publishing in the ELECTRICAL REVIEW of November 29th, 1935, names of firms exhibiting at the London Section of the British Industries Fair, we have received a more up-to-date list of exhibitors from which we have extracted the following additional names:—

Bellingham & Stanley, Ltd.
British Electric Domestic Appliances, Ltd.
British Vacuum Cleaner & Engineering Co., Ltd.
Brook, J. A., Ltd.
Bylock Electric, Ltd.
Chance Bros. & Co., Ltd.
Corfield-Sigg, Ltd.
Dictograph Telephones, Ltd.
Dominion Electrical Co.
Elliott, F. W., Ltd.
English Clock & Watch Manufacturers, Ltd.
Eureka Vacuum Cleaner Co., Ltd.
Grimshaw Baxter & J. J. Elliott, Ltd.
Hawkes, O. C., Ltd.
Hoover, Ltd.
Hughes, F. A., & Co., Ltd.
Injection Moulders, Ltd.
New Welbeck, Ltd.
Norma Technical Products, Ltd.
Vactric, Ltd.
Woodfyt Sales, Ltd.

Another exhibitor in the Birmingham Section whose name was not included in our list last week is Birmingham Electric Furnaces, Ltd.



A part of the Electrical Section at the Building Centre extensions

An Electrical Accessories Factory in Manchester

The Manchester Corporation proposes to grant a loan of £3,330 to a firm which intends to build a factory at Wythenshawe for the manufacture of electrical accessories. Authority to do this is given by the Manchester Corporation (General Powers) Act, 1930, which provides that the Corporation may advance money to the purchaser or lessee of any of the lands comprising the Wythenshawe estate for the purpose of enabling or assisting him to erect buildings on such land. It is understood that, at the commencement, the factory will employ from eighty to 100 people.

A Showroom for Bexhill

The Bexhill-on-Sea Town Council has approved a proposal of the Electricity Committee to establish a showroom and demonstration centre.

French Electrical Imports and Exports

The French import and export figures for electrical material for the first nine months of 1935 have now been published. They show that activity has been considerably reduced, imports dropping from 118,500 metric cwt. (248,000,000 fr.), to 76,000 cwt. (190,800,000 fr.), while exports decreased from 133,000 cwt. (159,000,000 fr.) to 128,100 cwt. (150,000,000 fr.). From these figures it will be seen that the unfavourable trade balance has been considerably reduced, having fallen to a little over 40 million fr. against 99 million fr. in the previous year. Increases are still shown, however, in imports of batteries, which rose by 2,032 cwt. (5,302,000 fr.), and in frames for electrical machines which rose by 35 cwt. (11,000 fr.). Spare parts show an increase in weight of 69 cwt., but their value dropped. In dynamo-electric machinery both imports and exports have fallen, the former by 3,617 cwt. (10,122,000 fr.), and the latter by 9,591 cwt. (10,854,000 fr.). The same situation is to be seen in regard to incandescent lamps, imports of which decreased by 658 cwt. (11,223,000 fr.) and exports by 681 cwt. (3,764,000 fr.). The most material falling off in imports—12,084 cwt. (32,921,000 fr.)—was shown by electrotechnical machinery; exports were 629 cwt. down as regards weight but their value rose by 9,874,000 fr. Imports of wires and cables for electrical uses showed a substantial drop, the figures being 20,586 cwt. (14,190,000 fr.) below those of the past year. On the other hand, exports of these goods increased by 4,557 cwt. (3,124,000 fr.). Carbons for electrical uses were likewise exported to a greater extent (1,724 cwt. advance), although the value of these exports was 475,000 fr. less than in 1934. Imports were lower by 5,245 cwt. (716,000 fr.). The same situation is to be noticed in porcelain and glass insulators, where imports were 934 cwt. (1,176 fr.) down, and exports 3,278 cwt. up with a drop in value of 875,000 fr.

The Building Centre Extensions

Since its formation just over three years ago the Building Centre, 158, New Bond Street, London, W.1, has attracted about a quarter of a million visitors and its success has been so great that the neighbouring Grafton Galleries have been acquired and are now connected with the main building by an all-welded bridge. The Electrical Section now occupies the whole of one of the main halls of the new premises, and the additional space available permits the exhibits to be much more effectively displayed than previously. At one end is an E.L.M.A. light-vision tester, while round the walls are sections or cubicles devoted to lighting fittings, fires, water-heaters, washers, dish-washing machines, clocks and domestic ultra-violet ray apparatus. Cookers, refrigerators and some of the smaller domestic appliances form attractive displays in the centre of the hall, and there is a special exhibit by the Lighting Service Bureau. Red and green " Osira " tubes concealed behind cross-bars illuminate the curved ceiling, additional lighting coming from examples of pendant fittings. In the entrance to the hall are specimens of convector, panel and tubular heaters, time switches and wiring accessories, together with a number of cable exhibits, including glass-covered floor panels showing typical cable layouts, &c. A separate section contains numerous electric fires, particularly of the inset variety. It is proposed to change the exhibits every two months, and a technical staff is always in attendance to answer questions and give additional information regarding displays.

American Electrical Manufacturing

The volume of electrical manufacturing business in 1935 was about 30 per cent. greater than in 1934, which was about the same increase as that for 1934 on 1933, says the president of the General Electric Co., quoted by *Reuter's Trade Service* from New York. The consumption of electricity in the United States was the largest recorded, being about 7 per cent. more than in 1934 and 3 per cent. more than in 1929, the previous peak year. As for last year, this was largely due to a greater use of electrical appliances in the home. Orders for capital goods in the electrical manufacturing industry have not increased to any great extent because of the difficult position of the public utilities and the transport companies in the United States. Practically the only increase in the production of capital goods has been brought about by the modernisation of industrial plants. Successive increases in the use of electricity must eventually mean an increase in the generating capacity of public utilities, which will mean more orders for capital goods to the electrical manufacturing industry.

E.D.A. (Coventry Circle)

The annual meeting of the Coventry Circle of E.D.A. was held on January 8th at the Corporation showrooms. Mr. F. C. Dain, in presenting the annual report, said the Circle appeared to have fulfilled a great need in Coventry as a

medium whereby the electrical interests could be brought together. Commander Neal (Midland Area Officer), referred to the Association's activities in the area and Councillor W. H. Malcolm (chairman of the Coventry Electricity Committee), mentioned the progress in Coventry in this direction. Capt. J. C. Chaytor, chairman of the Central England Committee of E.D.A., gave an address on the future development of electricity in this country, in which he stated that unless Corporations and electrical contractors worked in conjunction for the purpose of securing increased electrical business, Government action might be taken. Councillor Malcolm was elected president of the Circle, Mr. W. J. Marston (chief engineer and manager of the Corporation Electricity Department), chairman, and Mr. Dain, secretary. Messrs. H. Beesley and F. C. Brown, retiring members of the committee, were re-elected.

The Institute of Export

The aims of the Institute of Export, a new organisation which has been formed solely for the purpose of looking after the interests of British export trade, were outlined last Friday by Sir Francis Goodenough at an inaugural reception held at the Cordwainers' Hall, Cannon Street, London. The new body, which is an offspring of the British Export Society, will endeavour to obtain official recognition of exporting as a career, supervise the interests and improve the status of all those engaged in the export trade, set suitable standards of export training and organise special export courses, hold conferences, arrange lectures and publish information, &c., seek to impress manufacturers with the importance of highly organised exporting, and, in fact, promote "export-mindedness" generally. The president of the Institute is Major T. Knowles and the vice-presidents include Lord Hirst, Lord Meston, Sir Ernest Benn, Sir Francis Goodenough, Sir Harry McGowan, and Major Sir John Prestige. Membership falls under four main classes—member, associate member, student member and student, and particulars of the qualifications required are contained in a booklet obtainable from the secretary, 21, Tothill Street, London, S.W.1.

Electrical Equipment for a Rolling Mill

The Metropolitan-Vickers Electrical Co., Ltd., has received an order from the Cargo Fleet Iron Co., Ltd., for the electrical equipment for a new 32-in. reversing universal mill which is being installed at its Middlesbrough works. The equipment comprises the supply and installation of a 15,500-h.p. single armature reversing mill motor, complete with 4,600-kW flywheel motor generator set, switch and control gear and ventilating equipment. It will embody the most recent Met-Vick. developments in the design of electrical equipment for reversing mill drives.

The Institute of British Executives

Owing to the continual increase in membership and general expansion of work the Institute of British Executives is removing, as from January 27th, to Swan House, 79, High Holborn, W.C.1. The new premises are self-contained on two floors, the first floor providing a spacious club room, with reading and writing rooms adjoining, the second floor providing accommodation for administration offices, &c.

Social Events

Replying to the toast of the company, proposed by Mr. W. J. Cooper, burgh electrical engineer, Hamilton, at the annual supper of the Lothians Electric Power Co., at Edinburgh on January 8th, Mr. H. C. Babb, M.I.E.E., general manager, referred to the appointment of a commission to investigate the distribution of electricity in the country. It had for some time past been evident, he said, that the original legislation which allowed local authorities to obtain Provisional Orders for their own areas, which were generally densely populated and sometimes small, was wrong when applied to modern requirements, as the less densely populated areas, which were the most expensive to develop, were left to private enterprise to cultivate. In his opinion, the time had come for the 635 distribution authorities which existed in this country at present to have their areas reallocated. What the Commission would do he did not know, but the distribution of the country should be under unshackled expert management and operated so that the consumer got the best possible benefits after a reasonable allowance had been made on the capital expended.

The L.E.S. Sports and Social Club (L.E.S. Distributors, Ltd.), held a dance at the Victoria Coach Station on January 10th, at which about 200 members and their friends attended. The programme included old and new dances to suit all tastes, and spot prizes added to the enjoyment of a pleasant evening for which thanks are due to Mr. B. E. Mead, hon. secretary of the Club.

An E.D.A. Ball

The eighth annual dance of the Electrical Development Association (Northern Counties Area), held at the Oxford Galleries, Newcastle-on-Tyne, on January 10th, was attended by 1,200 guests. Nearly 200 prizes were given, and an enjoyable feature of the evening's entertainment was a cabaret. Mr. A. C. Cramb, director of E.D.A., and Mrs. Cramb, received the guests. It is expected that as a result of the dance last year's donation to electrical charities of £102 will be exceeded. The organising committee comprised Messrs. W. F. T. Pinkney (chairman), S. G. Pike, R. H. Davison, C. Gray, A. W. Bacon and A. Parkin (organising secretary).

Trade Commissioner's Visit

The Department of Overseas Trade announces that Mr. G. C. Pelham, H.M. Trade Commissioner and Commercial Secretary in Hong Kong, is at present in this country on an official visit. Mr. Pelham will be available at the Department during the period January 20th to February 8th, for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to Hong Kong and Southern China, after which he will visit a number of industrial centres in the provinces. Firms desiring an interview with Mr. Pelham in London or information regarding his arrangements to visit provincial centres, should apply to the Department at 35, Old Queen Street, London, S.W.1, quoting reference 15310/1/35.

The German Radio Industry

The number of radio subscribers in Germany has now passed the 7,000,000 mark, says Herr Hadamovski, chief of the German broadcasting organisation, quoted by *Reuter's Trade Service* from Berlin. This figure, he says, is the best refutation possible of the predicted imminent collapse of the German radio industry. Herr Hadamovski does not deny that difficulties have been experienced and that several wireless companies have become insolvent, but he attributes this to a general weeding out of the industry. Meanwhile, a company has been formed in Berlin to liquidate the stocks of bankrupt concerns so as to avoid a slump in prices on the German market. It is estimated that there are about 600,000 sets in stock.

Registered Electrical Contractors

At the last meeting of the Executive Committee of the National Register of Electrical Installation Contractors the following applications for registration were accepted:—

Spelman, E. R., Lowestoft.
Civil, T. A., Hexham.
Myles & McCaffery, Blackpool.

At the same meeting two applications were declined.

Transporting a Large Transformer

The accompanying illustration shows a large transformer, manufactured by the Metropolitan-Vickers Electrical Co., for the Belfast Corporation power station, at Alexandra Dock, Bel-

A large Met.-Vick transformer on route for the Belfast power station

fast. The total load was seventy tons, and the half-mile journey from the dock to the power station took two days, as steel plates had to be laid for the tractors to pass over.

For Sale

Messrs. Goddard & Smith will sell by auction on January 29th, at 70, Seymour Place, W.1, the stock of an electrical warehouse.

(See our classified advertisements.)

A Novel Desk Calendar

The Hotpoint Electric Appliance Co., Ltd., has sent us an attractive metal desk calendar. This consists of two Hotpoint "imps" holding up daily cards.

Dutch East Indies Lamp Import Restrictions

The National Council has approved an ordinance restricting the importation of foreign lamps. This measure is intended to check the importation of cheap foreign lamps and to encourage imports from Holland.

Dutch Radio and Lamp Exports

The Dutch Central Statistical Bureau reports that the volume of exports of radio apparatus declined from 689 metric tons

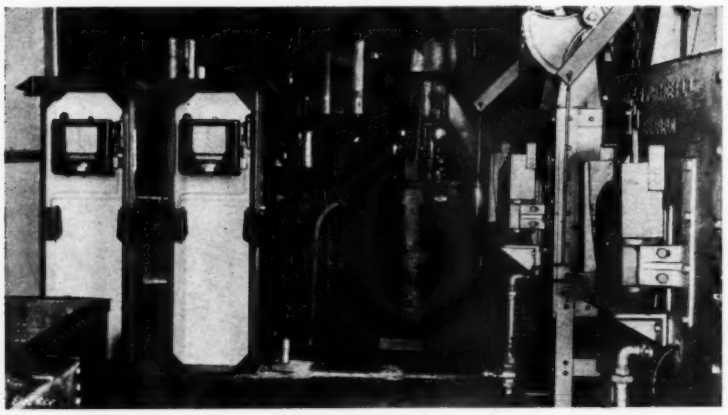
gross in November to 432 tons in December, and compares with 1,025 tons in December, 1934, the values being 3,114,000 fl., 1,963,000 fl. and 5,058,000 fl. in the three periods, respectively. For the twelve months the value of the exports has fallen off from 44,703,000 fl. in 1934 to 38,324,000 fl. in 1935, which was also less than the value of 39,599,000 fl. in 1933. Similarly, the number and value of wire filament lamps of over 16 V which were exported in December, 1935, was less than in the previous month and lower than in December, 1934. The value, which amounted to 8,520,000 fl. in 1933, declined to 6,687,000 fl. in 1934 and to 5,875,000 fl. in 1935.

Rawlplug Sales Conference

The sales staff and representatives of the Rawlplug Co., Ltd., held their annual conference at the company's offices, Rawlplug House, Cromwell Road, S.W., during last week. Among those who attended were Mr. L. Tweedie-Smith, managing director, Mr. H. A. Greenland, advertising manager, and Mr. H. W. Gilburt, sales manager. A dinner was held on January 8th, at the Monico, Piccadilly Circus, W.1, at which Mr. J. J. Rawlings (director) presided. Other directors present were Mr. R. W. Rawlings and Mr. L. Tweedie-Smith.

Batteries in the Stratosphere

In comparison with other types the aircraft battery is a featherweight design. An illustration of the rough handling these batteries will withstand is afforded by the recent American record-breaking stratosphere balloon ascent by Captains Stevens and Anderson, sponsored by the Army and the National Geographical Society, when a new world record of an altitude of approximately fourteen miles was made. The batteries, which were of the "Exide" aircraft type, were used in the operation of cosmic ray counters and other apparatus. On the descent it was found necessary to unship the batteries and various scientific instruments in order to permit the balloon to descend more gently. The batteries were attached to a parachute and thrown overboard when the balloon was at a height of ten miles. Despite this, they descended to earth quite safely without breakage or even spilling of the electrolyte.



Two Cambridge recording potentiometric controllers on heat-treatment furnaces at the Austin motor works

Irish Free State Electrical Imports

There was an active tone in the electrical trade in the Irish Free State during November last, the imports of electrical machinery and cognate material attaining a value during the month of £125,012 as compared with £123,680 in November, 1934. The appended table shows the imports during the first eleven months of the past two years:—

	January–November 1934	1935
	£	£
Electric motors	40,693	43,106
Other electrical machinery	253,396	187,206
Dry batteries and parts	29,366	29,910
Electric lamp bulbs	57,048	65,475
Electric lighting accessories, fittings and parts	47,644	72,218
Electric wires and cables (insulated)	79,551	82,039
Telegraph and telephone apparatus	10,557	27,692
Radio receivers, complete	95,547	112,581
Radio-gramophones, complete	6,713	5,631
Other radio apparatus, fully or partly assembled	9,670	5,953
Radio parts and accessories	84,174	81,363
Other electrical goods and apparatus	192,535	247,575
Totals	£906,894	£960,749

As will be seen, all but four items of the table show an increase, which for the eleven months amounts in the aggregate to £53,855.

Orders Recently Booked

Messrs. William Steward & Co., Ltd., have secured the contract for the lighting and power installation for the new factory of Messrs. William Pretty & Sons (1930), Ltd., at Ipswich.

Messrs. C. A. Parsons & Co., Ltd., have received an order for turbo-generator plant for the Ford Company (Canada), Ltd., of Windsor, Ontario. The plant will comprise a 20,000-kW turbo-generator, automatic condensing plant and a 5,000-kW non-condensing generator. As early delivery is essential more men are to be started at the company's works.

New Refrigerator Factory

On Wednesday Mrs. A. A. Sheridan laid the foundation stone of the new factory which British Electric Domestic Appliances, Ltd., are erecting in King's Way, Waddon, Surrey, especially for the manufacture of "Aerofrige" refrigerators. The factory will be completed by about the beginning of next month.

"Rejectostats"

In the course of a note on page 13 of our January 3rd issue we referred to "rejectostats." Messrs. Kolster-Brandes, Ltd., ask us to state that the word "Rejectostat" is their registered trade mark.

British Overseas Electrical Trade

The expansion in Britain's overseas electrical trade suffered a slight setback in December when, for the only time during the year, the total value of our exports was less than in the corresponding month of 1934. Imports were also down. The figures, abstracted from the Board of Trade returns for the month, were: Exports, £1,173,134 (−£1,835); imports, £307,719 (−£2,957). Nevertheless for the year as a whole the figures are exceedingly good. Following upon the 1934 increase of £1,972,622 in the value of our electrical exports there was, in 1935, a further expansion to the extent of £2,309,274, representing an improvement of 20.4 per cent. The total value was £13,622,250. Imports increased by £129,375 (or 3.6 per cent.) to £3,689,882, chiefly on account of an addition of £99,708 in the case of electric vacuum cleaners. A more detailed analysis of the returns will appear in the ELECTRICAL REVIEW of January 24th.

Automatically Regulated Furnaces

The accompanying illustration shows the heat-treatment furnaces recently installed by British Furnaces, Ltd., at the works of the Austin Motor Co., Ltd. The temperature is automatically maintained by two recording potentiometric controllers made by the Cambridge Instrument Co., Ltd. A new publication of the last-named company (Folder No. 51) illustrates typical automatically controlled furnaces and reproduces an untouched record obtained in service which shows that the temperature of 1,280 deg. C. was maintained within 0.4 per cent. over a ten-hour run.

Local Authority Undertakings

In 1923 the number of local authority undertakings was 327, the statutory powers of which were given in the "Administrative Volume of Electricity Supply Undertakings" issued by the Electricity Commissioners about ten years ago. Since then ninety-two local authorities have been granted distribution powers and forty-two have ceased to own the undertakings in their areas, giving a net increase of fifty and making a total of 377 at the present time. The newcomers include nine municipalities which bought out companies. Those no longer responsible for the supply of electricity comprise four merged in joint electricity boards, nine absorbed by large municipal neighbours, twenty which sold out to power companies, and eight which transferred their rights to local companies. The forty-second (Hitchin) was company-owned from 1924 to 1931, when the Urban District Council again became the authorised undertakers.

An Agricultural Information Service

It is proposed to set up at the Science Museum, South Kensington, a central agricultural and scientific bibliography service, the purpose of which is to make readily available to subscribers information on all aspects of agriculture—including the supply of materials and machinery—which is widely scattered throughout thousands of books and periodicals. The preliminary list of original subscribers contains the names of many large firms and influential people, and the hon. secretary (pro. tem.) is Mr. W. P. Dreaper, O.B.E., F.I.C., 27, Willow Road, London, N.W.3.

L.E.P. Sales Activities

A three months' exhibition programme has recently been concluded by the Lancashire Electric Power Co., the towns visited including Leyland, Tarleton, Burscough Bridge and Bamber Bridge, and the rural district of Samlesbury, to which the company has recently extended its supply. A number of novelties were introduced to arouse interest, such as cake weight guessing competitions at the cookery demonstrations; cooking competitions; and the invitation cards issued to consumers had a cash value and served as coupons. With the conclusion of the exhibition programme the company's travelling showroom now sets out on a four-months' tour in rural areas and smaller townships.

Trade Announcements

M. & C. Switchgear, Ltd., has appointed Messrs. Potter, Cowan & Co., Ltd., of 20, Waring Street, Belfast, as its agents for Northern Ireland.

Enfield Cable Works, Ltd., has opened new stores at the Southern Railway Goods Yard, Brighton Station (telephone:

Brighton 6429). Stocks of all types of rubber-insulated wires and cables and other products of the company are available. The branch manager is Mr. G. J. Moody.

Due to the close proximity of its new head office, the Sloan Electrical Co., Ltd., has closed its trade counters at Golden Lane and Kingsway, W.C.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price, January 15th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3½d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£195	£6 dec.
Grade II... ... ... ,,	£135	£4 dec.
Grade III ... ... ,,	£71	£2 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	7¼d.	¼d. dec.
c ,, Tubes (solid drawn) ... ... ,,	9¼d. to 10d.	—
c ,, Wire, basis ... ... ,,	7¾d.	¼d. dec.
c Copper Tubes (solid-drawn) ... ,,	10¼d.	—
g ,, Bars (best selected)... ... per ton	} £66	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£39	10s. dec.
d ,, ,, Wire Rods ... ,,	£45	10s. dec.
d ,, ,, H.C. Wire ... per lb.	7¾d.	⅛d. dec.
f Ebonite Rod ... ... ,,	1/6 to 2/– plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	6¾d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£17	15s. dec.
g Mercury ... ... per bot.	£12/7/6 to £12/18/6	—
e Mica (in original cases) small ... per lb.	6d. to 1/–	—
e ,, ,, medium ... ,,	5/– to 10/–	—
e ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11¼d.	¼d. dec.
p ,, ,, rolled strip & sheet ,,	11d.	¼d. dec.
p ,, ,, wire ... ... ,,	1/0½	¼d. dec.
o Platinum ... ... per oz.	£7 17s. 6d.	—
d Silicium Bronze Wire ... ... per lb.	8 ½d.	½d. dec.
g Spelter ... ... per ton	£14 7s. 6d.	3s. 9d. dec.
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
g Tin, Block (English) ... ... per ton	£213 5s.	£5 5s. dec.
s ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

E.M.B. Co., Ltd., Moor Street, West Bromwich.—A leaflet describing an explosion proof controller.

Falk, Stadelmann & Co., Ltd., 83/93, Farringdon Road, London, E.C.1.—A catalogue (No. 716) dealing with about 100 recently introduced wiring accessories.

Capac Co., Ltd., 6, Old Jewry, London, E.C.2.—A booklet describing "Bin-Aural" instruments for testing the internal condition of machinery.

Ever Ready Co. (Great Britain), Ltd., Holloway, N.7.—A list of replacement batteries and accumulators for radio sets.

Hopkinsons, Ltd., Huddersfield.—A pamphlet on ground thread stud bolts.

Holophane, Ltd., Elverton Street, Vincent Square, London, S.W.1.—Two catalogue pages dealing with the "Auralite" fitting.

Troughton & Young, Ltd., 143, Knightsbridge, London.—Two well-illustrated art catalogues of modern lighting fittings and "Ultralux" units.

Brook Motors, Ltd., Huddersfield.—A catalogue of single-phase motors.

Sloan Electrical Co., Ltd., 54, Fetter Lane, London, E.C.4.—A complete illustrated catalogue (330 pages) dealing with wiring supplies, ironclad switchgear, live material, bell and telephone equipment, domestic appliances, and lamps. Reference is facilitated by a very complete index.

G. Cohen, Sons & Co., Ltd., 600, Commercial Road, London, E.14.—A catalogue of reconditioned plastic moulding, rubber and hydraulic machinery.

British Insulated Cables, Ltd., Prescot, Lancs.—Leaflets dealing with foundry paints and cut-outs with meter connections. Also a booklet describing the B.I.-Macintosh "Under-the-Eaves" distribution system.

V.G. Manufacturing Co., Ltd., Gorst Road, Park Royal, London, N.W.10.—A booklet has been prepared on the "Simplat" glass sound-recording discs, recently described in our "New Apparatus" section.

T. Bolton & Sons, Ltd., P.O. Box No. 3, Widnes, Lancs.—"Durode," a new alloy for spot-welding tips, is described in a new pamphlet.

Bingham Appliances, Ltd., 48, Tooley Street, London, S.E.1.—A catalogue of poultry appliances, including electrically operated plucking machines.

Murex Welding Processes, Ltd., Ferry Lane Works, Forest Road, Walthamstow, E.17.—A technical booklet entitled "Arc Welding on Tramways" has been prepared.

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.—A publication in connection with "Philora" sodium and mercury industrial and floodlighting lamps.

Cochranes (Middlesbro') Foundry, Ltd., Middlesbrough.—A stock list of cast-iron spun-iron pipes.

Simplex Electric Co., Ltd., 159, Great Charles Street, Birmingham, 3.—Leaflet No. L.1519 illustrating public highways using Simplex lanterns.

Bankruptcy Proceedings

D. S. Williams, electrical engineer and contractor, 342, Dewsbury Road, Leeds.—Trustee, Mr. C. H. Baker, York House, Boar Lane, Leeds, appointed January 2nd.

H. Yeo, radio engineer, Market Place, Stratton, Cornwall.—First and final dividend of 3s. 2d. in the £, payable January 14th at the Official Receiver's offices, Exeter Bank Chambers, Broadgate, Exeter.

L. S. Walter, electrical engineer, 48, Broad Street, Banbury.—First meeting January 17th at 8, Forbury, Reading. Public examination February 5th at the Town Hall, Banbury.

D. R. Williams (Captain D. R. Williams & Co.), electrical engineer and contractor, 25, Esplanade Avenue, Porthcawl.—First meeting January 17th at the Official Receiver's office, Government Buildings, St. Mary's Street, Swansea. Public examination January 23rd at the County Court, Bridgend.

Company Liquidations

Broom & Wade, Ltd., High Wycombe.—With reference to the notice which appeared on page 65 of our last issue regarding this company it should have been stated that the notice related only to debts incurred prior to February 15th, 1935, on which date a new company, Broom & Wade, Ltd., was incorporated to acquire the business of the above-named company. In order to avoid any misunderstanding we are pleased to publish the following explanation of the position, received this week from Mr. A. E. Beauchamp, the secretary of the company :—

"On February 15th, 1935, the old company, Broom & Wade, Ltd., went into voluntary liquidation for the purpose of reconstruction, and on the same date a new company (of similar name) was incorporated to acquire the business. On the same date a liquidator was appointed to wind up the affairs of the old company and it is only in respect of any debts incurred prior to the above date that the liquidator is interested, all debts since that date having been incurred by the new company who have discharged and will continue to discharge them in the normal course of business."

We understand that the new company held its first annual general meeting on December 17th, 1935, when a maiden dividend of 10 per cent. on the ordinary shares was declared. The directors' report showed that the turnover for the year ended September 30th, 1935, had only been exceeded once in the history of the business.

J. Gauld & Co., Ltd., electrical engineers, &c., Farnham Road Trading Estate, Slough.—The accounts filed under the compulsory liquidation of this company show total liabilities of £1,737 (ranking £1,531); assets £244, an issued capital of £588, and a deficiency of £1,990. Mr. J. Barwick Thompson, Official Receiver, reports that the company was formed in September, 1934, to acquire for £500 in shares the above business then being carried on by John Alexander Gauld under the style of J. Gauld & Co. On the incorporation of the company Gauld was appointed managing director at a salary of £500 a year, which was reduced to £250 in December, 1934. A receiving order was made against him on March 25th, 1935, when he resigned his managing directorship and was thereupon appointed manager. The change appears to have been a nominal one only. The accounts prepared for the company show that from the inception of the company to the appointment of a debenture holder's receiver on July 13th, 1935, the company made a gross profit of £88, but a net loss of £1,990. The failure of the company is attributed to lack of working capital, accentuated by losses on two big contracts. In the opinion of the Official Receiver the failure is directly attributable to mismanagement on the part of the directors in that the working capital placed at the company's disposal was totally inadequate for its requirements, and further that the overhead expenses, particularly with regard to salaries and travelling and entertainment expenses, were excessive. Mr. C. Latham has been appointed liquidator with a committee of inspection.

Green & Jackson, Ltd.—Winding up voluntarily. Liquidator, Mr. J. E. Hartles, Alston Buildings, Spiceal Street, Birmingham.

Private Arrangements

W. L. Lewis, trading as Neon Erection and Maintenance Co., 107, Dalberg Road, S.W.2.—A meeting of creditors was held on January 6th, when it was reported that the ranking liabilities were £272 and the net assets £102, leaving a deficiency of £170. The principal assets were book debts, which totalled £155 and were estimated to realise £70. The debtor commenced the business in 1933 and in July of the following year was joined by a partner. During the 12 months to June, 1935, the turnover was £1,451, with a net profit of £110, whilst the drawings aggregated £316. The partnership was then dissolved, and the debtor had since traded alone. During the last six months the turnover was £433, with a net loss of £25, and the debtor did not draw anything. He believed that if given time friends would assist him. It was decided that the meeting should be adjourned to allow the debtor to make an offer.

Electricity Supply

Lighting, Domestic, Power

Banks.—OVERHEAD LINES.—The Lancashire Electric Power Co. has received the Minister of Transport's permission to erect overhead lines in Gravel Lane.

Blackpool.—AIRCRAFT BEACON.—It is considered likely that Blackpool Tower will be illuminated at night and during foggy weather to act as an aircraft beacon. The tower is 558 ft. high.

Brierfield.—MODIFIED TARIFF.—The rateable value basis of assessing the standing charge under the two-part tariff has been introduced by the Urban District Council, resulting in considerable concessions to occupiers of houses of over £12 rateable value. The "unit" charge has been reduced from ¾d. to ½d.

Bristol.—LARGE LOAN FOR MAINS AND SUB-STATIONS.—The Electricity Committee is seeking sanction to borrow £120,000 for mains and sub-station equipment.

Bury.—ILLUMINATED BOUNDARY SIGNS.—The Electricity Committee has erected, at the borough boundary on the main Bolton road, an illuminated device which shows the borough coat-of-arms, and bears the word "Bury." The design is the first of six which are to be erected at road boundaries.

Canterbury.—SUPPLY TO A HOSPITAL.—The City Council has offered a supply of electricity to the new Kent and Canterbury Hospital at a charge of £6 10s. per kVA of maximum demand, plus ¾d. per kWh, subject to a minimum annual revenue of £250 per annum for five years.

Cardiff.—CHEAPER LIGHTING FOR SCHOOLS.—The lighting charge for schools is to be reduced to 2¾d. per kWh, and the heating rate to ¾d. per kWh.

Chichester.—A TWO-RATE TARIFF.—The City Council has adopted a two-rate heating tariff for business premises, under which the charges will be 0.6d. per kWh from 4 a.m. to 4 p.m., and 1¼d. per kWh from 4 p.m. to 4 a.m.

Clitheroe.—INQUIRY.—Mr. T. J. D. Atkinson, K.C., a Ministry of Transport inspector, held an inquiry recently into an objection against the Corporation's carrying a cable over a private road leading to a farmer's house. The Corporation pointed out there was not a satisfactory alternative route, and that if the line were placed underground at that point the farmer demanded £20 compensation. The inspector visited the area.

Douglas (I.O.M.).—PROPOSED EXTENSIONS.—Pending the receipt of further information the Electricity Committee has deferred consideration of the report prepared by the borough electrical engineer in connection with a proposal to install additional plant at the Pulrose power station, at an estimated cost of £25,000. It is intended to install a new 3,750-kW turbo-alternator with auxiliaries, a house service set, switchgear, etc.

Ealing.—ILLUMINATED BEACONS.—Internally illuminated Belisha beacons have been installed along the Uxbridge road.

East Ham.—NEW MAINS.—The Town Council is to borrow £2,404 for mains extensions in the Church Road area.

Egham.—GREAT WEST ROAD LIGHTING.—Following upon a series of experiments with electric-discharge and filament lamps in various types of lanterns carried out by the Egham and Staines Electricity Co., Ltd., at the Causeway, Egham, a scheme was adopted for the illumination of two-and-a-half miles of the Great West Road, the major portion of which has now been completed. The main installation comprises primarily steel tubular columns with brackets projecting 5 ft. over the roadway, supporting the light sources 25 ft. above the road surface, at intervals of 150 ft. on alternate sides of the road. The 400 W Philips mercury-vapour lamps mounted in Revo "Magnalite M.V.D." fittings project wide beams of moderate magnification throughout two zones between 80 deg. and 25 deg. to the downward vertical in both directions, with and against the traffic on the road. Through the shopping centre of Egham, where it was not considered advisable to disturb the existing spanwire system, fifteen similar units, which have special diffusing glass cylinders to enclose the light source, are centrally suspended at a mounting height of between 20 and 22 ft. On the Egham Hill section towards Sunningdale, at the request of the local Council, a lower intensity of illumination has been provided by adopting a 30 ft. mounting height for the same type of lighting units erected at 300 ft. intervals.

A view of Egham Hill illuminated by electric-discharge lamps

Ely.—RURAL EXTENSIONS.—The Beds, Cambs and Hunts Electricity Co. has informed the Rural District Council that mains are to be extended to Little Downham and Sutton.

Gainsborough.—SUB-STATION.—Application for a loan of £700 for a sub-station and site for the building is being made by the Urban District Council.

Glasgow.—LIGHTING IMPROVEMENTS.—Suggestions made by the inspector of lighting with a view to improving street lighting in the Broomielaw area have been approved by the Lighting Committee.

GENERATION AT A HOSPITAL.—With regard to the electric lighting system at Woodilee mental hospital, the Health Committee has called for a further report from the electricity manager with regard to the cost of installing new generating plant.

Great Britain.—STORM DAMAGE.—The electricity services were among those affected by the gales last week. There were failures at Lytham St. Annes, South Bank and Grangetown, near Middlesbrough. It is reported that virtually the whole of North Wales from the coast down to Barmouth was in darkness for a time; at some places, such as Bangor, the failures were intermittent and of short duration. The Cheshire rural areas also suffered interruptions, while Droitwich and several villages by Southampton Water were affected. Telephone communication suffered to a greater extent. It was estimated that, for a time, 24,000 subscribers were cut off and that £50,000 worth of damage was done. Most of this was in the rural areas. A report from our Belfast correspondent indicates that conditions in Northern Ireland were also severe, a number of overhead lines being damaged.

Grimsby.—ELECTRICITY WANTED AT LUDFORD.—The Electricity Department is to be approached with a view to a supply of electricity being made available at Ludford.

Halifax.—SUPPLY TO MIXENDEN.—The mains are to be extended, at an estimated cost of £1,410, to give a supply to Mixenden.

Houghton-le-Spring.—SUPPLY TO HOUSING ESTATE.—The North-Eastern Electric Supply Co., Ltd., is applying for consent to the erection of an overhead cable on the Colliery Row housing estate.

Hull.—DOCK LIGHTING.—The *Fishing News* states than an improvement long overdue is being put into operation within the next few days at St. Andrew's Dock, Hull, namely, the supersession of gas lighting by electricity. The electrical installation is also being extended to the signal lights at the entrance to the dock, doing away entirely with the old-fashioned method of gas-lighted signal lamps.

India.—CALCUTTA STATISTICS.—Replying to a question by the Raja Bahadur of Nashipur in the Bengal Legislative Council recently, Sir John Woodhead stated that the amount of energy supplied by the Calcutta Electric Supply Corporation was as follows:—1932, 63,468,184 (d.c.) and 121,666,140 (a.c.); 1933, 62,077,214 (d.c.) and 128,074,234 (a.c.); and 1934, 66,143,736 (d.c.) and 163,792,931 (a.c.).—*Commercial Gazette.*

Japan.—POWER DEVELOPMENTS.—Our Yokahama correspondent reports that the communications authorities are considering the plans of the North-Eastern Development Power Co., Ltd., for the establishment of generating stations with a total capacity of 148,000 kW on the Tazawa Lake, Okuirise River, Miyako River, Abukama River and Yakuwa River. An 18,000-kW generating station is also to be erected by the Niigata Power Co. on the Inami River.

Leyton.—REVISED CHARGES.—The Town Council has adopted the following new scale of charges:—Lighting flat rate, 3½d. per kWh; maximum demand rate, 5d. per kWh for 91 hours of m.d. per quarter, and 2d. per kWh beyond; prepayment meters, 4½d. per kWh; heating 1d. per kWh; power, 1½d. per kWh; maximum demand power rate, 3d. per kWh for 91 hours of m.d. per quarter, and 1d. beyond; alternative domestic rate, Christmas and Lady Day quarters, first 100 kWh per quarter at 3½d. per kWh and ¾d. beyond; midsummer and Michaelmas quarters, first 50 kWh at 3½d. per kWh and ¾d. beyond; cooker domestic rate, flat rate of ¾d. per kWh. There are also special rates for cinemas and large factories; the total reductions represent a sum of £15,200 per annum.

London.—IMPORTANT LIGHTING RECOMMENDATION.—We reported in our issue of January 3rd that tenders for electric and gas lighting at Camberwell—the streets of the borough are at present almost entirely lighted by gas—had been considered by the Council. The latest development is a recommendation of the Works Committee that a fifteen-year street lighting contract shall be entered into with the County of

London Electric Supply Co., Ltd., at an annual cost of £23,550.

SOUTHWARK.—The Electricity Committee is seeking sanction to borrow £15,000 for "free" wiring schemes.

Luton.—TEACHING GIRLS ELECTRIC COOKING.—An electric cooker is to be installed at the Chapel Street senior girls' school in order that pupils may be taught to cook by electricity.

Maidstone.—LOANS.—Sanction to loans of £5,000 for substations and equipment and £923 for heating and lighting installations at new offices and stores has been received by the Electricity Committee.

SPECIAL ORDER.—The Electricity Commissioners have granted an order permitting the Council to supply electricity to premises at Chart Sutton.

Motherwell and Wishaw.—WORK SCHEMES.—Subject to the approval of the Electricity Commissioners the Town Council has agreed to proceed with work recommended in the electrical engineer's report, namely, the augmentation of plant and cable capacity, the conversion to a.c. supply of four areas of the burgh and the laying of additional cables. The estimated cost is £34,266.

Plymouth.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £3,500.

Reigate.—LOWER CHARGES.—The County of London Electric Supply Co., Ltd., has reduced its charges in the Chipstead and Merstham areas added to the borough but not supplied by the Corporation. The new lighting flat rate is 5½d. per kWh (instead of 6d.) and the "unit" charge of the two-part tariffs ½d. (1d.). When the Croydon Rural Special Order is passed the flat rate in the areas will be further reduced to 5½d. per kWh six months after the passing of the Order, with a reduction to 5d. a year later.

Richmond (Yorks).—SUPPLY TO SKEEBY.—The North-Eastern Electric Supply Co., Ltd., is to start work shortly on supplying electricity to Skeeby.

ALTERNATIVE CABLE.—The Electricity Committee has entered into negotiations with the North-Eastern Electric Supply Co., Ltd., with regard to an alternative supply in view of the fact that the existing line is rapidly approaching saturation point.

Rochdale.—RECOVERING HIRE-PURCHASE ARREARS.—The point was raised at a recent Town Council meeting whether defaults in the payment of instalments on apparatus supplied on hire-purchase terms could legally be collected by adjusting the meter so that a greater proportion of every shilling went in paying off these arrears. A councillor stated that, in the event of payments not being made under agreements, the Corporation had a remedy in the County Court where the judge would decide how much should be paid monthly.

Scarborough.—COUNCIL AND THE C.E.B.—At a meeting of the Electricity Committee recently, consideration was given to the question of the Council entering into an agreement with the Central Electricity Board under the Electricity (Supply) Act, 1935, in respect of the operation of the Corporation's generating station. The Committee also considered a report by the electrical engineer regarding the proposed arrangements and how they would affect the Buckrose Light and Power Co., Ltd. It was decided to defer further consideration, and in the meantime to secure an independent report.

SUB-STATION.—The Town Council is to erect a sub-station at the junction of Scalby Road and Woodland Ravine.

South Africa.—BEAUFORT WEST PLANT.—The electrical engineer of Beaufort West, Cape Province, has reported to the Town Council that the electrical plant needs overhauling, but that this will not make it efficient. Although the undertaking showed a profit on the past year's working, the machinery was uneconomical when compared with modern steam plant burning the cheapest grades of fuel. The Council decided to send the report to the consulting engineer, Mr. A. Adendorff, of Cape Town, with a request that he should investigate the position with a view to the plant being reconstructed.

Southall.—SUB-STATION.—The Metropolitan Electric Supply Co., Ltd., is to erect a sub-station in Lady Margaret Road.

Startforth (Yorks).—SUPPLY TO COTHERSTONE.—The North-Eastern Electric Supply Co., Ltd., is to start work shortly on supplying electricity to the parish of Cotherstone, in the Startforth rural area.

Swansea.—MAINS EXTENSIONS.—Schemes for the extension of mains at Newton (£809), Fforestfach (£952), and Sketty (£500), have been approved by the Electricity Committee.

Sunderland.—NEW RECTIFIERS.—The first of two new rectifiers to replace old plant was recently installed at the power station. It was supplied by the General Electric Co., Ltd., and the switchgear by Messrs. A. Reyrolle & Co., Ltd.

Uxbridge.—ELECTRICAL INSTALLATIONS.—A decision has been made by the Urban District Council to embark upon a scheme for the provision of electrical installations in all Council houses which at present are without such facilities.

Wakefield.—ELECTRIC HEATING FOR PUBLIC BATHS.—The Baths Committee has decided to use electricity for heating its new Sun Lane baths. The cost is estimated at £1,996 and the annual running charges at £750.

Wallsend.—NEW CABLE.—Plans prepared by the North-Eastern Electric Supply Co., Ltd., for low-voltage cables in Woodbine Avenue and Hawthorn Grove have been approved by the Town Council.

Wareham.—LOWER CHARGES.—The Bournemouth and Poole Electricity Supply Co., Ltd., has reduced the standing charge for the domestic all-in rate by 10s. per annum, and has announced a new charge of ½d. per kWh for water heating.

Warrington.—MAINS AND SERVICES.—Sanction has been obtained to a loan of £20,000 for mains and services.

COMMERCIAL COOKING TARIFF.—The Electricity Committee has fixed the price of off-peak energy for commercial cooking at ½d. per kWh, subject to control by a time switch.

Whickham-on-Tyne.—HOUSE INSTALLATIONS.—The Whickham-on-Tyne Urban District Council has accepted the offer of the North-Eastern Electric Supply Co., Ltd., to install electric lighting in forty-four houses at Dunston and thirty-four at Whickham.

Whitby.—RURAL EXTENSIONS.—The North-Eastern Electric Supply Co., Ltd., has applied to the Ministry of Transport for permission to proceed with electricity extensions to Lealholm and Glaisdale, in the Esk Valley.

Winchester.—OVERHEAD LINES.—The City Council is to erect overhead lines in the Dean Lane area and an extension is to be made in Colson Road and Wales Street, at a cost of £396.

Wolverhampton.—EXTENSIONS.—An additional supply is to be given to Guy Motors, Ltd., Park Lane, at a cost of £571, and new plant is to be provided by the Electricity Committee at the Commercial Road station at a cost of £2,752 to meet the requirements of the Transport Committee. The Electricity Committee is to also extend mains at a cost of £7,012 to provide an increased supply to the British Oxygen Co., Ltd.,

Canadian Hydro-electric Development in 1935

THE annual review of hydro-electric development in Canada during 1935 shows that 362,080 h.p. has been added to power plants already in operation, bringing the total to 7,909,115 h.p. This means that 18.4 per cent. of the potential power of the Dominion has now been harnessed, the surveyed water-power resources of Canada being placed at 43,000,000 h.p. The new installations were chiefly additions to existing developments, such as the canyon plant of the Ontario Government on the Abitibi River (three 66,000 h.p. units) and to the Beauharnois plant of the Beauharnois Light, Heat & Power Co. on the St. Lawrence River. Greater activity in the mining industry was responsible for new installations of various sizes in the Yukon, British Columbia, Manitoba and Ontario.

The Yukon Consolidated Gold Corporation completed the installation of an additional 5,000 h.p. unit at its station on the north fork of the Klondike River, twenty-six miles from Dawson. In British Columbia, Bullion Placers, Ltd., completed a 500 h.p. installation, while Pioneer Gold Mines installed a 380 h.p. unit in place of a 100 h.p. one, and Quesnol Light & Power started work on a 200 h.p. plant on Baker Creek. New installations in contemplation include a 2,000 h.p. addition to the plant of the British Columbia Nickel Mines, a 375 h.p. project by Bayonne Consolidated Mines, Ltd., on Summit Creek, near Tye, and several other projects chiefly connected with the mining industry. In Manitoba the God's Lake Gold Mining Co., Ltd., completed a 1,900 h.p. installation at Kanuchuan rapids, on Island Lake River, together with a 41-mile transmission line carrying power to the mine. The City of Winnipeg is contemplating the addition of a third unit at its Slave Falls station on the Winnipeg River.

In Ontario, apart from the Abitibi River plant, the Hydro-electric Power Commission brought into operation the Government-owned plant at Rat rapids, on the Albany River, with an installed capacity of 1,200 h.p., and the Commission is adding a second unit of 1,650 h.p. to be ready for operation next year. In Quebec the Beauharnois Light, Heat & Power Co., after starting its sixth 50,000 h.p. unit in December, 1934, completed the installation of the seventh and eighth units in 1935, while the MacLaren-Quebec Power Co. is adding a fourth 30,000 h.p. unit to its High Falls plant on the Lièvre River. Among the new developments contemplated in the province are a 20,000 h.p. installation by the Noranda Power Co. on the upper Ottawa River, and a 10,000 h.p. plant to be built by the Central Quebec Light & Power Co. at Ulverton rapids, on the St. Francois River.

In the Maritime province, the Nova Scotia Power Commission is adding a 4,300 h.p. unit to its Ruth Falls station on East River Sheet Harbour. The Annapolis Power & Paper Co. carried out some preliminary construction work on a projected 3,000 h.p. development on Paradise Brook, in Nova Scotia. Important extensions to transmission systems were made in both Nova Scotia and New Brunswick during the year.—*Reuter's Trade Service.*

at Lower Walsall Street, and in connection with the supply to the Boulton Paul Aircraft, Ltd., at Pendeford at a cost of £4,922.

Worthing.—SUPPLY EXTENSION.—A supply is to be provided by the Electricity Committee to the Newlands Park estate at a cost of £1,277.

RURAL SUPPLIES.—The Mid-Southern Utilities Co. informs us that it proposes to supply electricity to Burpham, Lyminster, Poling and Warningcamp in connection with the scheme reported in last week's issue of the ELECTRICAL REVIEW.

Traction

Brighton.—TROLLEY-BUSES FAVOURED.—Despite the active campaign to resist the introduction of trolley-buses the ballot of ratepayers last week resulted in support for the Corporation's Bill for power to run trolley-bus services. The voting was 13,802 in favour and 5,290 against.

Cleethorpes.—TROLLEY-BUSES.—The Great Grimsby Street Tramways Co. is seeking powers to run trolley vehicles in the Cleethorpes urban district.

Derby.—TROLLEY-BUS SERVICE.—At its recent meeting the Town Council approved a recommendation of the Omnibus Committee for converting the Osmaston Park Road route to trolley-bus operation.

One of the G.E.C.-Leyland trolley-buses which are being used in Tasmania

London.—KENSINGTON.—It is reported that the Borough Council has decided to cease using horse-drawn dust and water carts and to replace them by electric vehicles.

Wirral.—RAILWAY ELECTRIFICATION.—Representatives of the L.M.S. Railway and the Wallasey Corporation met at Liverpool last Friday to discuss the Wirral railway electrification scheme. The question of the electrification of the Seacombe line was raised, but the railway company felt that no case could be made for this.

Tasmania.—A TROLLEY-BUS SERVICE.—The Hobart City Council recently inaugurated a trolley-bus service—the first in the country. (See accompanying illustration.)

Communications

Germany.—RADIO LICENCES.—On January 1st there were 7,192,952 radio licences in use, states an *Exchange* message.

Great Britain.—MORE RADIO LISTENERS.—During December 944,530 wireless licences were issued by the Post Office. This is a net increase of 46,440 during the month, and brings the total in force at the end of the year to 7,415,709. At the end of 1934 there were 6,780,570 licences in force, and at the end of 1933 the number was 5,974,150.

TELEVISION.—It was announced this week that television transmissions to the public from Alexandra Palace are to begin in June. There will be three periods each day, namely, from 3-4 p.m., 6.15-7.15 p.m. and 9.30 to 10.30 p.m. The Baird and Marconi-E.M.I. systems will be used on alternate weeks. Mr. G. Cock, the B.B.C. television director, envisages the establishment of "viewing rooms" in large stores or news theatres, although no firms have, as yet, been approached officially. Test transmissions are expected to begin in March.

FUTURE OF RADIO RELAY SERVICES.—Concern is being felt among radio relay operators regarding the future of the industry, and the report of the Ullswater Committee to Parliament is eagerly awaited. There is a general feeling that the Committee will recommend that it should be made compulsory to relay B.B.C. programmes when they are available, which, in the case of a two-programme service, would only permit the use of foreign programmes before 10.15 a.m. in the mornings and early on Sundays. Some operators are installing extra wires to provide for a three-programme service, while others are investigating the possibilities of relaying three programmes over their existing four wires, as is the practice in Holland. No new concessions can be developed at present owing to the refusal of the Postmaster-General to grant new licences pending publication of the Committee's report.

NEWCASTLE-ON-TYNE AERODROME RADIO.—In conjunction with the Air Ministry the City Council is to spend £1,500 on radio equipment for the Woolsington aerodrome.

India.—A MUNICIPAL TRANSMITTER.—A small short-wave transmitting set, with the necessary ancillary equipment, is to be installed at Bangalore. According to the *Commercial Gazette*, the City Council is providing the set at a cost of about Rs.5,000 because reception of other Indian stations is difficult, and, moreover, the music broadcast by Bombay and Calcutta does not appeal to the Bangalore public. It is intended to install receiving sets and amplifiers in various parts of the city for entertainment purposes.

World Broadcasting.—*Reuter* reports from Munich that, according to the South German Press, there are now 35,700 transmitting stations in the world, about 7,700 (or roughly 22 per cent.) of them broadcasting entertainment programmes. The remaining 28,000 stations are concerned with radio services for ships, aeroplanes and other interests. Continental Europe alone has 2,000 stations which serve aeroplane traffic. Roughly four per cent. of the world's transmitting stations (numbering 1,448) are equipped for radio telephone services.

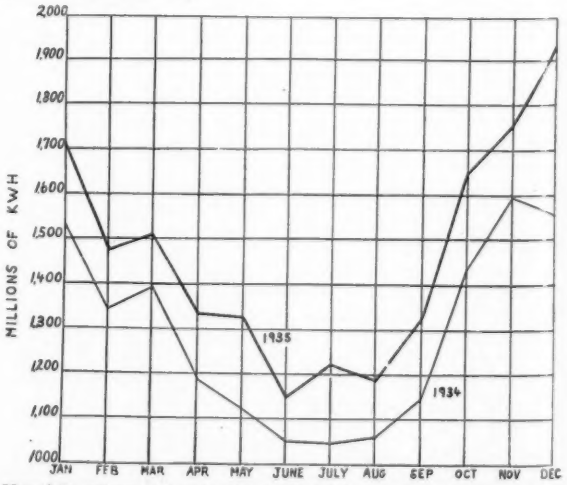
RADIO CONFERENCE.—On February 27th a conference is to be convened by the International Broadcasting Union to discuss regulation of the short waves, the interchange of programmes and copyright questions.

Generation of Electricity

THE official returns rendered to the Electricity Commissioners show that 1,929 million kWh of electricity was generated by authorised undertakings in Great Britain during December, 1935, as compared with the revised figure of 1,557 million kWh in the corresponding month of 1934, representing an increase of 372 million kWh, or 23.9 per cent. The number of working days in the month (*i.e.*, excluding Sundays and Bank Holidays) was 24, the same as last year.

During the year ending December 31st, 1935, the total amount of electricity generated by authorised undertakings was 17,565 million kWh, as compared with the revised figure of 15,462 million kWh for 1934, representing an increase of 2,103 million kWh, or 13.6 per cent.

Last year closed with the monthly generation figures rapidly approaching the 2,000 million kWh mark, and, as the accompanying curves clearly show, in each month the output was substantially in excess of the corresponding period of 1934, the difference being most pronounced in May, July and December. Special illuminations—the Royal Jubilee, Southend-on-Sea pier centenary, floodlighting at the Zoological Gardens, and many other similar schemes carried out at that time were, no doubt, partly responsible for the greater proportionate increase in the first two of these months, while in the case of the third it is necessary to take into account that whereas December, 1934, was unusually mild, at the beginning of last month we experienced a period of cold, foggy weather conducive to the greater use of electricity.



Monthly output of authorised electricity undertakings in 1934 and 1935

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—MELBOURNE.—February 24th. City Council. 22,000-V and 6,600-V switchgear. (T.Y. 10314.)*
BRISBANE.—April 17th. City Electric Light Co. Automatic outdoor-type booster transformers. (T.Y. 10321.)*
April 24th. 1,943 yd. of underground cable. (T.Y. 10323.)*

Barry.—January 21st. U.D.C. Electric lamps, bells, conduit fittings, &c., for a period of twelve months from April 1st. E. R. Hinchcliff, surveyor to the Council, Council Offices.

Blackpool.—February 11th. Corporation. Contracts 1 and 2: Screening plant, with electric motors, starting gear, electrically driven wash water pumps and accessories. Contracts 3 and 4: Large capacity vertical spindle axial flow pumps with electric motors, starting gear and accessories. Borough engineer, Municipal Buildings (deposit £1 1s. in each case).

Bradford.—January 20th. Corporation. Electric lighting at new nurses' home, St. Luke's Hospital. Office of the City Architect, Town Hall.

Caithness.—February 1st. County Council. Heating and electrical work for additions and alterations at Wick High School. Sinclair Macdonald & Son, architects, Wick (deposit £2 2s.).

Cardiff.—January 21st. Electricity Department. R.D.C. Supply, laying and jointing of underground feeder and distributor cables. (January 10th.)

Carlisle.—January 24th. Electricity Department. Equipment for lighting a thoroughfare by electric discharge lamps. (January 10th.)

Dagenham.—February 3rd. Engineer and Surveyor's Department. Electrical installations on housing estate. (See this issue.)

Dumfries.—January 31st. Electricity Department. Two 300-kVA transformers. (See this issue.)

East Retford.—January 22nd. Electricity Department. Switchgear, rectifiers and transformers. (January 10th.)

Egypt.—CAIRO.—January 28th. Ministry of Public Works. Electric washing machines and hydro-extractor. (T.Y. 5600.)*

Gainsborough.—February 7th. Electricity Department. Materials for twelve months. (January 10th.)

Gildersome.—January 27th. U.D.C. Electric lighting in eighty-five houses. Surveyor, Council offices (deposit £2 2s.).

Guildford.—January 20th. Guildford and Godalming Joint Hospital Board. Wireless receiving apparatus for the Woodbridge Isolation Hospital. E. W. Sellings, clerk to the Board, Millmead House.

Harrogate.—January 31st. Electricity Department. Steel kiosks. (See this issue.)

Hastings.—January 30th. Electricity Department. Materials. (January 10th.)
February 10th. Electricity Department. Materials for three years. (See this issue.)

Hazel Grove and Bramhall.—January 24th. Electricity Department. Sub-station switchgear equipment. (January 10th.)

Heston and Isleworth.—January 23rd. Electricity Department. One 5,000-kVA and two 600-kVA transformers with on-load tap-changing gear, 11,000-V truck-type cubicle and l.p. switchgear. (January 10th.)

Hoylake.—February 1st. U.D.C. Automatic electrically driven pumping plant, including pumps, motors, starting gear, &c., in connection with the Lower Green pumping station. W. H. Maitland, Town Hall.

Huddersfield.—January 24th. Corporation. Automatic electric lift in the Estate Buildings. (January 10th.)

Hull.—January 21st. Electricity Department. Meters stores for one year. (January 10th.)

Ilford.—January 24th. Electricity Department. E.h.p. switchboard and oil switches. (January 3rd.)

Kettering.—January 29th. Electricity Department. 11,000-V switchboard, cable and joint boxes. (January 3rd.)

Lincoln.—February 1st. Electricity Department. Materials for twelve months. (See this issue.)

Liverpool.—January 20th. Electric Supply Department. Materials for twelve months. (January 3rd.)

London.—HAMMERSMITH.—January 22nd. Borough Council. Stores and materials for twelve months. (January 3rd.)
KENSINGTON.—February 8th. Borough Council. Electrically propelled tractors. (See this issue.)

Manchester.—January 31st. Electricity Committee. Remote-electrically-controlled 33-kV switchgear with circuit-breakers. (January 10th.)

Middlesbrough.—January 27th. Electricity Department. 11,000-V cable. (January 10th.)

Middlesex.—February 12th. County Council. Switchboard at Harefield Sanatorium. (See this issue.)

Morecambe and Heysham.—February 5th. Electricity Department. Static transformers. (January 10th.)

Musselburgh.—January 20th. Town Council. Electrical work at new public washhouses at South Street. J. Logan, Burgh Surveyor, Town Hall.

New Zealand.—WELLINGTON.—March 3rd. Public Works Department. Machine tools and electrical and pneumatic equipment for the Wigram aerodrome workshops. (T.Y. 5612.)*
April 21st. 50-kW, 3-phase, 415-V, 50-cycle, Diesel-engine-driven generating set. (T.Y. 10302.)*
March 11th. Post and Telegraph Department. 100 miles of insulated bronze wire. (T.Y. 10293.)*
March 9th. 1,500 metal-cased condensers. (T.Y. 10310.)*
March 11th. 2,500 fuses and fuse wire. (T.Y. 10303.)*
DUNEDIN.—March 27th. City Corporation. Two three-phase transformers and 6,600-V and 35,000-V switchgear. (T.Y. 10309.)*

Paisley.—January 27th. Corporation. Wireless equipment for the new infectious diseases hospital. Medical Officer of Health, 14, Gilmour Street.

Plymouth.—January 21st. Electricity Department. Two 16-kW motor-generators with control gear. (January 10th.)
February 8th. Meters, time-switches, cables and wireless rectifiers. (See this issue.)

Prestonpans.—January 21st. Town Council. Electric lighting at forty-six houses. R. and A. K. Smith, surveyors, 4, Forres Street, Edinburgh.

Sheffield.—February 10th. Electricity Committee. Two 30,000-kW turbo-alternators with condensers and auxiliaries. (January 10th.)

Shipley.—January 31st. Electricity Department. L.p. cables. (January 10th.)

Southend-on-Sea.—February 3rd. Electricity Department. Stores for one year. (January 10th.)

South Africa.—GEORGE.—February 19th. Municipality. Plant for the reconstruction of the electricity undertaking, consisting of boilers and steam-raising plant, turbo-alternators, one 400-kW alternator and switchgear. E. Val Davies, consulting engineer, Johannesburg.
JOHANNESBURG.—January 27th. Railways and Harbours Administration. Two 25-ton capacity overhead electric travelling cranes. (T.Y. 5579.)*
February 3rd. 10-ton capacity overhead electric travelling crane. (T.Y. 5582.)*

Southampton.—January 28th. Electricity Department. Cables, kiosks, 6,600-V ring-main breakers, switchgear and reactor. (See this issue.)

Southport.—January 27th. Electricity Department. 175-kW single-bulb mercury-arc rectifier. (See this issue.)

Stoke-on-Trent.—February 5th. N.W. Midlands J.E.A. Transmission lines, transformers, painting chimney stacks, spraying cooling towers, &c. (See this issue.)

Swansea.—January 24th. Electricity Department. Materials for twelve months. (January 3rd.)

Torquay.—February 3rd. Corporation. Supply of electric lamps, &c., during the period beginning April 1st next. Borough engineer.

Welton.—January 27th. R.D.C. Electrical pumping machinery comprising two horizontal motors and two direct-coupled turbine type centrifugal pumps. Elliott & Brown, Burton Buildings, Parliament Street, Nottingham (deposit £3 3s.).

Worthing.—February 6th. Corporation. Street lighting equipment. (See this issue.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Aberdeen.—Education Committee. Accepted. Electrical work at the new primary school, Seaton Place (£720).—W. T. Gill.

Blackpool.—Highways Committee. Accepted. Wiring, distribution board and switchgear for Bispham highways depot.—Nelson Bros., Ltd.

Dumfries.—Electricity Committee. Accepted. Extensions to h.p. switchgear (£431).—Ferguson Pailin, Ltd.

East Ham.—Health Committee. Recommended. X-ray equipment (£920).—A. E. Dean & Co.

Ely.—R.D.C. Accepted. Electric lighting at ninety-four houses (£211).—Grensells & Co., Kettering.

Essex.—County Health Committee. Accepted. Electric lighting battery renewals at High Beech sanatorium.—Pritchett & Gold & E.P.S. Co., Ltd.

Glasgow.—Health Committee. Accepted. Five electrically driven hydro-extractors for the Ruchill Hospital laundry (£940).—Watson, Laidlaw & Co., Ltd.
Housing Committee. Accepted. Electrical installation at Possil Road estate (£107).—Darroch & Espie.

Greenock.—Accepted. Electric lighting at the Rankin Memorial Children's and Maternity Hospital (to be erected at a cost of £43,000).—Hurry Bros.

Lanark.—County Council. Accepted. Electric lighting at 150 houses at Cambuslang (£883).—Darroch & Espie.

London.—FULHAM.—Electricity and Lighting Committee. Recommended. Electric vehicles: One 15 cwt. (£293) and one 6 cwt. (£243).—Tomlinsons, Ltd. Further plant for the new generating station: Boiler feed pumps (£2,486).—Mather & Platt, Ltd. Condensing plant (£33,173).—Vickers-Armstrongs, Ltd. E.h.p. cables (£1,543).—W. T. Henley's Telegraph Works Co., Ltd.

Maidstone.—Town Council. Accepted. Cables (£10,298).—Union Cable Co., Ltd.

Norfolk.—Health Committee. Accepted. Rewiring at Melton Lodge (£112).—H. Noble, Norwich.

Plymouth.—Electricity Committee. Accepted. Switchgear and transformers (£29,517).—Metropolitan-Vickers Electrical Co., Ltd.

Shinclife.—Parish Council. Accepted. Poles, overhead network and street lighting.—F. Reid Ferens & Co., Ltd.

Wakefield.—Housing Committee. Accepted. Wiring 192 houses on the Peacock Farm estate.—H. Smith.

Whitby.—Accepted. Overhead network in connection with an electricity supply for Hinderwell.—R. Reid Ferens & Co.

Winchester.—City Council. Accepted. 100-V 50 cell battery with a capacity of 100 Ah.—Tudor Accumulator Co., Ltd.

Wolverhampton.—Electricity Committee. Recommended. Three switch units (£450), two switch units (£400), and switch cubicle (£101).—Ferguson Pailin, Ltd. Two switch units (£2,439), one switch unit (£1,336), and circuit-breaker (£421).—General Electric Co., Ltd. Two switch units (£2,755).—A. Reyrolle & Co., Ltd. One 300-kVA transformer (£128), one 300-kVA transformer (£168), and one 200-kVA transformer (£88).—Electric Construction Co., Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Monday, January 20th. Institution, London. 7 p.m. Informal meeting. Discussion on "Small Motors." To be opened by Mr. R. A. Lochner.

Mersey and North Wales (Liverpool) Centre.—Monday, January 20th. The University, Liverpool. 7 p.m. "Equipment and Performance of Steel-Tank Rectifier Traction Substations Operating on the London Underground Railways." Mr. A. L. Lunn.

Tees-Side Sub-Centre.—Monday, January 20th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. "Applications of the Hot-Cathode Grid-Controlled Rectifier or Thyratron." Mr. A. L. Whiteley.

North Midland Centre.—Tuesday, January 21st. Hotel Metropole, Leeds. 7 p.m. "Recent Developments in Long-Distance Telephony." Mr. A. C. Timmis.

Dundee Sub-Centre.—Thursday, January 23rd. University College, Dundee. 7.30 p.m. "Electric-discharge Lamps and Their Uses." Mr. L. J. Davies.

North-Eastern Centre.—Friday, January 24th. Grand Assembly Rooms, Barras Bridge. 7 for 7.30 p.m. Annual dinner and dance.

Institute of Fuel.—Friday, January 17th. British Industries House, London, W.1. 6.30 for 7 p.m. Informal meeting. "The Public Supply and Distribution of Steam and Hot Water." To be opened by Messrs. F. W. Shilstone and A. Monkhouse.

Association of Supervising Electrical Engineers.—Tuesday, January 21st. E.L.M.A. Lighting Service Bureau, London, W.C.2. 7.15 p.m. "The Isolation of Machinery in Regard to Vibration and Noise." Mr. R. B. Grey.

Institution of Railway Signal Engineers.—Wednesday, January 22nd. Institution of Electrical Engineers, London. 6 p.m. "Design, Manufacture, and Examination of Mechanical Signalling Apparatus." Mr. P. W. Hardman.

Radio Wholesalers' Federation.—Thursday, January 23rd. Savoy Hotel, London, W.C.2. 6.30 for 7 p.m. First dinner.

Birmingham Electric Club.—Friday, January 24th. Grand Hotel, Birmingham. 7 p.m. Presidential address.

Electrical Engineers' Dance.—Friday, January 24th. Grand Hotel, Harrogate. 8 p.m.

Institution of Mechanical Engineers.—Friday, January 24th. Institution, London. 6 p.m. "Exhaust Turbines for Marine Propulsion, with Special Reference to the Rowan-Götaverken System." Mr. J.-B. O. Sneeden.

Physical Society.—Friday, January 24th. Imperial College of Science and Technology, London, S.W.7. 5 p.m. Presidential address by Lord Rayleigh.

Notes

E.I.B.A. Tees-side Ball

Mr. H. Haigh, borough electrical engineer of Middlesbrough, reminds us that the annual ball of the Tees-side Branch of the Electrical Industries Benevolent Association is to be held on Friday, February 28th.

E.P.E.A. Dinner at Nottingham

The annual dinner of the Derby and District Section (which has about 180 members) of the Electrical Power Engineers' Association was held at Nottingham last Saturday, Mr. A. P. Hayes, of Derby, presiding. Mr. H. E. Davidson, Birmingham (member of the N.E.C.) proposed the toast of "The City of Nottingham," and mentioned that the undertaking's output last year was 102 million kWh, having been doubled in five years. The Lord Mayor (Sir A. Ball) responded. Although chairman of the Corporation gas undertaking, he agreed that electricity was bound to progress, and might have to take first place in lighting, but both gas and electricity could be of service to mankind. Mr. J. Mould (city electrical engineer, Leicester) submitted the toast of "The Association," and spoke of the harmony existing in that district between representatives of employers and employés. Mr. Colin Cooper, who responded, emphasised the value of the Association to the industry, and the respect entertained by all sections for the work done on the negotiating committee of the National Board by Ald. E. Huntsman. The health of the chairman was proposed by Ald. Huntsman.

The Electrical Association for Women

The spring programmes of the Association and its London Branch contain promise of many enjoyable functions. The third business hour luncheon on February 12th, when Sir Raymond Unwin, member of the new Government Committee on Housing, will be the principal speaker, is of particular note on account of the Association's deep interest in house-planning, for which, incidentally, a special sub-committee has recently been appointed. Details of a visit to the British Industries Fair on February 22nd and of the annual conference from May 13th to 15th will be available shortly.

The winter programme of the North-East Coast Branch was commenced on Monday, when Miss Agnes Jennings, of the Newcastle Housing Improvement Trust, was to give an address on "Women and Housing." On Monday, February 10th, there will be a talk on "Other Women's Associations," and the annual general meeting and dinner-dance will be held at the Royal Station Hotel, Newcastle, on March 13th.

On January 9th the North-West Midlands Branch held its annual dinner at the North Stafford Hotel, Stoke-on-Trent, Mrs. H. Leese presiding. At the annual meeting of the Farnworth Branch held on the same day it was reported that 65 new members had been enrolled last year, bringing the total to 252.

Gale Fatalities at Rawtenstall

Mr. J. E. Shepherd, the borough electrical engineer of Rawtenstall, tells us that during the gale on January 9th two persons were killed at Crawshawbooth, which is in his area of supply, by a falling tree which brought down the street lighting wires with it. Some publicity was given to this accident, and in one paper in fairly bold headlines it was stated that the woman was killed by the tree and the man electrocuted. The inquest was held on January 11th, and in view of the medical evidence and the police evidence the Coroner's verdict was "Accidental death," both persons dying as a result of fractured skulls. No evidence of electrocution was visible on either body, and the Coroner was of the opinion, from other evidence, that the wires were dead.

A Fresh View on Pylons

The extract from the Overstone School Magazine given below appears to indicate a more tolerant and progressive view of electrical development among the younger generation. The authoress is aged fifteen, and we are assured by Mr. W. F. T. Pinkney that the composition owes nothing to parental inspiration:—

One after one
Across the wild moor striding,
One after one
Upon the bare hill rising.
Their forms like ghosts of warrior men
In line are standing.
Mysterious, transparent.
The outposts of a modern world,
A new world forming.
Somehow they seem to blend, the new and old.
The old hills make their forms look fairy-like.
And yet with fields and furrows they look cold,
And are ungainly.
Yet outposts of a modern world they stand,
A new world forming.—JEAN PINKNEY.

The Glare Problem

In Mr. D. G. Sandeman's article on this subject on page 52 of the January 10th issue the formula was unfortunately incorrectly printed. It should read $I/h^2\theta^{3/2}\mathrm{cosec}^2\theta$. It may be added that the photographs reproduced in the article were taken on the same panchromatic film, exposed for identical times (two minutes) on the same night, with the same aperture F6.5 under identical weather conditions, and the camera remained in the same position throughout.

Appointments Vacant

Full-time assistant master in machines and machine drawing at the South-East London Technical Institute for the L.C.C.

Chief maintenance engineer for the Borough Polytechnic.

Electrical foreman for the Sudan Government.

Junior draughtsman for Hampstead Electricity Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

DAYSTAR lamps.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Lord Hirst of Witton has been asked by the Grand Council of the Federation of British Industries to accept nomination as president of the Federation for the coming year, and has agreed to do so. The presidential year commences in April. Through his chairmanship of the Empire Committee Lord Hirst has rendered signal service to the F.B.I. during recent years. **Lord Aberconway,** C.B.E., of Messrs. Thos. Firth & John Brown, Ltd., and **Mr. A. H. Kilner,** of Courtaulds, Ltd., have been nominated as additional vice-presidents of the Federation.

[British Broadcasting Corporation
Mr. H. L. Kirke

Mr. H. L. Kirke, head of the Research Department, Engineering Division of the British Broadcasting Corporation, left London on January 9th for Bombay, to advise the Indian Government on the technical problems associated with the expansion of the broadcasting service in India.

Mr. H. N. Munro, Accumulator Makers' Association, has been elected chairman of the London Centre of the Institute of Industrial Administration for 1936.

Mr. E. J. Power has resigned his position with the Burnham and District Electric Supply Co., Ltd., as engineer and secretary. The future administration of the company will be under the direction of **Mr. E. W. Tole,** the general manager of the North Somerset Electric Supply Co., Ltd., which holds the controlling interest in the Burnham Co. The secretary of the North Somerset Co., **Mr. L. Franks,** F.I.S.A., has been appointed secretary of the Burnham Co., and **Mr. D. E. Hayter** has been appointed resident engineer and manager. Mr. Hayter has had considerable experience in the electricity supply industry in the North Somerset area.

Mr. E. Crocker, installation engineer in the Birmingham Corporation Electric Supply Department, was recently presented by his colleagues with a gold cigarette case and a fountain pen set at a dinner given to him upon his retirement. Mr. F. Forrest, city electrical engineer, presided, and others present included Ald. Sir Percival Bower (chairman of the Electric Supply Committee) and Mr. E. J. Jennings (secretary and commercial manager).

Mr. L. C. Gamage, secretary of the General Electric Co., Ltd., and director in charge of the export business of the company, left England on January 9th for a tour of the various branch establishments of the company in Australia

Mr. and the Hon. Mrs. L. C. Gamage at Victoria Station en route for Australia and New Zealand

and New Zealand, and will be returning home by way of Canada and the United States in June. The purposes of the visit are to consolidate the many advances made, to open up fresh avenues of trade, and to strengthen the ties which exist between England and the countries to which Mr. Gamage is going. He will be accompanied on his tour by his wife, the Hon. Mrs. Gamage, the elder daughter of Lord Hirst.

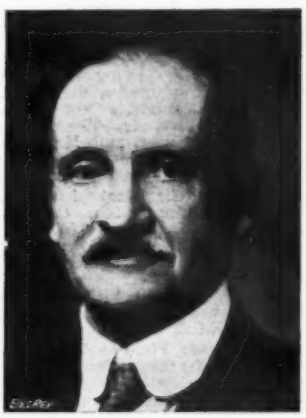
Mr. F. J. Elliott, A.M.I.E.E., author of the article on "The Two-part Tariff" (page 92), is chief engineering assistant to the Wolverhampton Corporation Electricity Department, having held this position since 1930. He started his career in 1908 as a pupil in the Bristol Electricity Department, and successively held the positions of engineer in charge of the various rotary sub-stations and motor and rotary convertors; charge engineer, main generating station; assistant consumers' connection engineer; and assistant mains engineer (1922 to 1930). He was associated with the change-over in Bristol, which involved a capital expenditure of approximately £1,000,000 and took about five years to complete. In the year that he went to Wolverhampton an assisted-wiring scheme was started there, and about 12,000 consumers are now taking supplies under this scheme. The change-over has been completed and mains laid in every street in the borough, while 100 square miles of the rural area has been developed, all the villages and most of the farms being connected to the mains.

[Whitlock & Sons, Ltd.
Mr. F. J. Elliott

Mr. W. S. Ross, borough electrical engineer and manager at Reigate, has resigned on attaining the age of sixty years and on having completed forty years' local government service. Owing to his state of health the Town Council has granted him leave of absence until the end of March, and will accept his resignation as from that date. Pending the appointment of a successor **Mr. C. Rowbotham,** mains superintendent, will be the acting engineer and manager.

Consequent upon the retirement of **Mr. J. Fairburn** from the position of works superintendent at the Valley Road power station, the Bradford Corporation has promoted **Mr. A. J. S. Waddell** to be power station superintendent and **Mr. J. Mills** to be operation assistant.

Mr. S. P. Doudney has retired from the service of British Insulated Cables, Ltd. An old Faradian, he joined the company as a pupil forty-two years ago, and after a short time in the test room was transferred to the Estimating Department. He was in charge of this department for over thirty years, until his appointment as representative of the company in London on association matters, a position which he held until his retirement.



Mr. S. P. Doudney

Mr. W. Forbes, assistant engineer, L.N.E.R., Edinburgh, has been appointed technical engineering assistant to the Cardiff Corporation Transport Department at a salary of £500.

Mr. C. M. Jacobs, signal engineer to the Great Western Railway Co., who is retiring on February 1st, entered the company's service in the Telegraph Department in 1882, and five years later was transferred to the chief office of the department under the late Mr. C. G. Spagnoletti. In 1896 he was appointed technical assistant, and on the amalgamation of the Telegraph and Signals Departments in 1903 he became electrical assistant to the signal engineer, Mr. A. T. Blackall, upon whose retirement, in June, 1923, he was appointed assistant signal engineer, becoming signal engineer five years later.

Mr. W. B. Thorpe, M.I.E.E., M.I.Mech.E., engineer-in-chief of the Charing Cross Electricity Supply Co., Ltd., is retiring on the completion of forty years' service. He has been appointed advisory engineer to the London Associated Electricity Undertakings, Ltd.

Mr. C. H. Archer, heating engineer with the Automatic Electric Co., retired from that position on December 31st.

Obituary

Mr. T. I'ons.—We learn with regret that Mr. Thomas I'ons, a director of Messrs. Veritys, Ltd., died in a Calcutta nursing home on January 9th after a brief illness. Mr. I'ons was in his 68th year, and had been connected with the Verity business for 45 years. After a short period in London he formed the installation departments and took charge of them in Manchester, Edinburgh and Birmingham. He took sole charge of the export department, in which capacity he frequently visited India and other overseas countries; indeed, he was on a tour of India, the Straits Settlements, &c., when he contracted a chill which caused his death.

[*Beatrice Cundy, London*
The late Mr. T. I'ons

Mr. H. C. Parsons.—We regret to record the death, which occurred on January 7th at his home at Twickenham, of Mr. Henry Clifford Parsons, a member of the staff of the British Electrical and Allied Manufacturers' Association. Mr. Parsons was born at Taunton in 1892 and he entered the service of Newton Brothers, of Taunton, at the age of sixteen. During his twenty years' service with the company he advanced to be head of the sales organisation. He joined the staff of the B.E.A.M.A. in December, 1928, and was connected with the work of the transformer section. He was a Fellow of the Incorporated Secretaries Association, and took an active interest in problems of industrial planning, works administration and cost accounting, on which subjects he wrote articles for the ELECTRICAL REVIEW and other technical journals. Of late his health had not been good, but his death after a week's illness came as a shock to his friends and associates. The Association has lost a loyal officer and the staff a valued friend. Mr. Parsons leaves a widow and one son. The funeral took place at Hampton Hill, Middlesex, on Monday last.

Mr. J. Burril.—The death occurred suddenly on January 7th of Mr. Jesse Burril, an electrical engineer, employed by the Nottingham Corporation in charge of the heating and lighting at the Council House. Mr. Burril, who was about fifty-six years of age, was at work in the boiler-house, when he suddenly collapsed and died.

Mr. J. Friedmann, who held an executive position for over fifty years at the head office of Messrs. Falk, Stadelmann & Co., Ltd., passed away on January 10th in his seventy-first year.

Wills.—Mr. J. Augustus Bower, managing director of the Bower Engineering Works (Electrical and General), Ltd., left £14,330 (net personalty £11,332).

Mr. H. St. Lawrence Smith, late assistant secretary to the Eastern Telegraph Co., left £26,263, with net personalty £25,923.

Sir John Field Beale, K.B.E., J.P., chairman and managing director of Messrs. Guest, Keen & Nettlefolds, Ltd., and of British (Guest, Keen, Baldwins) Iron & Steel Co., Ltd., left £35,726 (net personalty £21,896).

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

J. R. Wrigley & Bros., Ltd.—Private company. Registered January 8th. Capital, £300 in £1 shares. Objects: To carry on the business of electricians, radio engineers, electrical engineers and contractors, &c. The directors are: C. Wrigley, 18, Back Virginia Street, Southport, and two others.

Holroyd (Glassware & Lighting), Ltd.—Private company. Registered January 6th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in glassware, lighting fittings, metal artware, &c. The subscribers are: R. A. Kennedy and M. Rogers, both of 62, London Wall, E.C.2. Registered office: 2, Basil Street, Knightsbridge, S.W.3.

Carr Gee, Ltd.—Private company. Registered January 3rd. Capital, £300 in £1 shares. Objects: To carry on the business of electrical engineers, manufacturers of and dealers in electrical appliances and apparatus, general, mechanical and motor engineers, etc. The subscribers are: G. H. Kyte, B.Sc., electrical engineer, and Mrs. Kate G. Kyte, B.A., both of 3, Heolgam Road, Bridgend. Secretary and registered office: H. Hudson, Bank Chambers, Bethany Square, Port Talbot.

Interohm Electrical Insulators, Ltd.—Private company. Registered January 8th. Capital, £45,000 in £1 shares (36,000 preferred ordinary and 9,000 ordinary). Objects: To adopt an agreement with F. V. Wythes, and to carry on the business of constructional, mechanical, electrical, and water engineers, &c. The subscribers are: E. W. Keen, "Crantock," Hazeldene Drive, Pinner, and A. J. Clark, 5, Glebe Road, Hornsey, N.8. Solicitors: Ashurst Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.2.

Chain Store Finance Trust, Ltd.—Private company. Registered January 6th. Capital, £100 in £1 shares. Objects: To carry on the business of purchasing, selling, letting for hire and/or hire purchase, radio and television instruments and apparatus, gramophones, gas and electric heating, cooking and refrigerating apparatus, &c. The subscribers are: F. Millidge, 17, Whorlton Road, Peckham, S.E.5, and N. P. Berguer, 19, Clyde Road, Wood Green, N.22. Registered office: 53, Worship Street, E.C.

Superadio (Clacton), Ltd.—Private company. Registered December 19th. Capital, £1,000 in 500 cumulative preference shares of £1 each and 2,000 ordinary shares of 5s. each. Objects: To acquire the business of radio and electrical engineers, dealers and manufacturers carried on by D. W. Heightman and H. A. Smith as "Superadio" at 60, Rosemary Road, Clacton-on-Sea. The directors are: D. W. Heightman, 59, Burrs Road, Clacton-on-Sea; and H. A. Smith, St. Ives, 29, Agate Road, Clacton-on-Sea. Registered office: 60, Rosemary Road, Clacton-on-Sea.

Manufacturing R.A.P., Ltd.—Private company. Registered January 4th. Capital, £5,000 in 4,900 ordinary shares of £1 each and 2,000 deferred ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in wireless and television instruments, pianos, gramophones, &c. The directors are: W. H. Berriedale Johnson, and Mrs. B. Berriedale Johnson, both of "Thornhill," St. Mary's Road, Long Ditton, Surrey. Registered office: Ferry Works, Thames Ditton, Surrey.

F. S. Lambourne & Co., Ltd.—Private company. Registered January 1st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio and television instruments, &c. The directors are: F. S. Lambourne, "Glorious Devon," Belford Road, Davyhulme, near Manchester, and F. D. Bromley, 3, York Street, Manchester.

Southampton Broadcast Relay Service, Ltd.—Private company. Registered January 10th. Capital, £5,000 in 1s. shares. Objects: To establish and carry on services for relaying radio programmes and matter in Southampton and surrounding districts, &c., and to enter into an agreement with the Corporation of Southampton and Broadcast Relay Service, Ltd. The directors are: Sir Herbert B. Grotrian, Bt., K.C., J.P., "Knolls," Leighton Buzzard, and three others. Registered office: Bush House, Aldwych, W.C.2.

Honeysett Radio, Ltd.—Private company. Registered January 11th. Capital, £400 in £1 shares. Objects: To acquire the business of a wireless and electrical goods dealer carried on by Gertrude H. Honeysett at 71a, Manchester Road, E.14. The directors are: G. H. Honeysett (permanent), 71a, Manchester Road, E.14; and H. M. Walsh, 255, Globe Road, E.2. Registered office: 94/96, Commercial Street, E.1.

J. P. Christie & Co., Ltd.—Private company. Registered in Edinburgh January 9th. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and wholesale and retail dealers in all kinds of wireless and television instruments, loud speakers and accessories, &c. The directors are: J. P. Christie, 29, Victoria Road, Aberdeen; and D. Wood, "Rose Tor," 119, Anderson Drive, Aberdeen. Registered office: 29, Victoria Road, Aberdeen.

Neosid, Ltd.—Private company. Registered January 9th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers and workers of and dealers in electricity, motive power and light, &c. The directors are: E. Michaelis (permanent), 14, Talbot Square, W.2; and A. N. D. Smith, 56, Kingsway, W.C.2. C.A. Solicitors: P. S. Solomon Archer & Co., 5, Bedford Row, W.C.1.

Degallier's, Ltd.—Private company. Registered January 11th. Capital, £100 in £1 shares. Objects: To carry on the business of wireless and electrical engineers, &c. The subscribers are: Odette Degallier, Portman Mews South, Marble Arch, W.; and F. J. Hammond, 208, Hungerford Road, N.7. Solicitors: Canter, Hellyar & Co., 3/4, Lincoln's Inn Fields, W.C.2.

Eirco Services, Ltd.—Private company. Registered in Belfast December 31st. Capital, £2,000 in £1 shares. Objects: To carry on the business of electrical engineers, wholesale manufacturers of electrical equipment, factors and dealers in wireless and electrical goods, &c. The directors are: L. Scop, 17, Downview Avenue, Belfast, and two others. Registered office: 19, Ormeau Avenue, Belfast.

Bates & Grace, Ltd.—Private company. Registered December 21st. Capital, £100 in £1 shares. Objects: To carry on the business of suppliers and distributors of electrical appliances and machinery, &c. The permanent directors are: R. I. W. Bates, Redmarley, Sandringham Road, Gatesfield, near Fareham, and E. Grace, 3, West Street, Soberton, Hants. Solicitors: Warner & Son, Fareham, Hants.

Returns of Electrical Companies

Midland Electric Corporation for Power Distribution, Ltd.—Particulars have been filed of 3½ per cent. 1st mortgage debenture stock to secure £300,000 authorised July 25th, 1935, dated December 31st, 1935, constituting a specific charge on properties in the counties of Stafford and Worcester, and a floating charge on the company's other assets, present and future, including uncalled capital. The whole amount is now issued. Trustees: Electrical Finance and Securities Company, Ltd. The whole of the £300,000 stock has been issued at 99 per cent. (The company has reserved power to create and issue further stock ranking *pari passu* with the present issue provided that the total stock, including such further stock shall not exceed £1,000,000.)

Uxbridge and District Electric Supply Co., Ltd.—Satisfaction in full on December 12th, 1935, of trust deed dated May 23rd, 1911, and registered June 7th, 1935, securing £75,000 5 per cent. debenture stock.

British Crystal Lamp Co., Ltd. (formerly British Crystalite Co., Ltd.).—G. S. Rate, Glenelly, Ardleigh Green Road, Hornchurch, was appointed receiver on January 6th, 1936, under powers contained in debentures dated June 28th, 1934.

Electric Driers, Ltd.—Capital, £2,000 in £1 shares. Return dated October 11th, 1935. All shares taken up. £1,950 paid. £50 considered as paid. Mortgages and charges, nil.

Magbat, Ltd.—Capital, £3,000 in £1 shares. Return dated November 6th, 1935. 2,550 shares taken up. £2,550 paid. Mortgages and charges, £1,800.

Towyn, Aberdovey & District Electricity Co., Ltd.—Debenture, dated December 20th, 1935, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

W. J. Marchant (Electrical Engineers), Ltd.—Debenture, dated December 22nd, 1935, to secure £80, charged on the company's assets, present and future, including uncalled capital. Holder: Marion W. Marchant, 74, Walman Road, Tunbridge Wells.

Electrical Cleaners, Ltd.—The nominal capital has been increased by the addition of £1,000, beyond the registered capital of £500. The additional capital is divided into 1,000 7 per cent. cumulative redeemable preference shares of £1 each.

A. F. Bulgin & Co., Ltd.—The nominal capital has been increased by the addition of £8,000 beyond the registered capital of £2,000. The additional capital is divided into 2,500 10 per cent. cumulative preference and 5,500 ordinary shares of £1 each.

Berkeley & Young, Ltd.—Satisfaction to the extent of £17,000 on December 4th, 1935, of debenture dated September 14th, 1931, and registered September 17th, 1931.

Palestine Electric Corporation, Ltd.—Satisfaction in full on (1) March 30th, 1935, of trust deed dated October 18th, 1928, and registered December 21st, 1929, and (2) between April 5th, 1935, and May 31st, 1935, of trust deed dated August 6th, 1931, and registered August 27th, 1931. Notices filed December 31st, 1935.

Telephone Rentals, Ltd.—Capital, £800,000 in 3,200,000 ordinary shares of 5s. Return dated July 1st, 1935. 2,400,000 shares taken up. £100,000 paid on 400,000 shares, £500,000 considered as paid on 2,000,000 shares. Mortgages and charges, nil. On July 4th, 1935, a further 400,000 shares were allotted, payable in cash with 7s. 6d. per share (including premium of 2s. 6d.) called up.

Electrix, Ltd.—Capital, £100 in 2,000 ordinary shares of 1s. Return dated October 15th, 1935. All shares taken up. £100 paid. Mortgages and charges: £350.

Anglo-Swiss Electrical Co., Ltd.—Capital, £500 in £1 shares. Return dated October 10th, 1935. All shares taken up. £500 paid. Mortgages and charges, nil.

British Electric Hydrators, Ltd.—Particulars filed of £500 debentures authorised November 22nd, 1935, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital (subject to "A" mortgage debentures), the amount of the present issue being £300.

Readylock, Ltd.—Issue on December 23rd, 1935, of £700 debentures, part of a series already registered.

City Notes

Aeronautical & General Instruments, Ltd.—An issue was made last week of 380,000 ordinary shares of 5s. each at par. This company, the registration of which was recorded in our last issue, has been formed, in particular, to acquire the instrument business (other than wireless receiving sets and parts for home use) carried on by Radio Instruments, Ltd. The assets to be taken over are valued at £62,588, for which £62,500 is being paid. Of this £37,500 will be in cash and £25,000 in 100,000 shares of 5s. each credited as fully paid, but from the cash consideration the vendor is discharging all liabilities, other than those under contracts taken over, amounting to approximately £37,000. The net proceeds of the issue will be available for extensions to the building and plant and as fresh working capital, in addition to the £20,291 of liquid assets acquired. The issue was underwritten by Electric & General Industrial Trusts, Ltd. Mr. J. Joseph, managing director of Radio Instruments, Ltd., has agreed to devote the whole of his time to the company in the capacity of managing director for a period of seven years. The issue was quickly oversubscribed.

The Cornwall Electric Power Co.—According to the *Financial Times*, a consolidation of Cornish electricity interests involving issued share capital of over £500,000 is proposed. The Cornwall Electric Power Co. proposes to absorb nine associated interests and the two electricity undertakings at Illogan and Redruth of the Urban Electric Supply Co. The following are the companies concerned: Callington & District Electric Supply, Camborne Electricity Supply, East Cornwall Electricity Supply, Launceston & District Electric Supply, Newquay Electric Light & Power, Penzance & District Electric Supply, Truro Electricity Supply and West Cornwall Electricity Supply. It is also proposed to acquire the electricity supply business of the Liskeard Gas & Electric Supply Co.

The Westinghouse Brake & Signal Co., Ltd., reports a profit for the year ended September 30th last of £175,456 after providing for depreciation, taxation, &c., as compared with £23,615, to which is added £4,194 brought in, making £179,650. The dividend for the year is 10 per cent., less tax (against 2½ per cent.), general reserve receives £50,000, and the amount carried forward is £42,666. Meeting: February 11th.

Broadcast Relay Service, Ltd.—In the opinion of the board the capital structure of the company does not adequately represent the actual capital employed. It proposes, therefore, to distribute £254,300 of the capital reserve to shareholders by the issue of two ordinary shares of 1s. fully paid in respect of each ordinary share of 1s. now held. It is also proposed that the capital be converted into stock which can be transferred in multiples of 5s. An extraordinary meeting to consider a resolution for increasing the capital will be held on January 31st.

Companies Struck off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved:—Barnetts Electrical Supply Co., Ltd.; Golden Voice Radio, Ltd.; Hughes Electric Supplies, Ltd.; Non-Directional Microphone Co., Ltd.; Oates Electrical Components, Ltd.; Swan Radio, Ltd.

Edmundsons Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during December, as compared with the corresponding month of 1934, show an increase of 24 per cent. in kWh sold.

The North Wales Electric Power Co. has deposited a Bill in Parliament to empower the company to increase its share capital from £1,000,000 to £3,000,000.

The Electrolytic Zinc Co. of Australasia has declared a dividend of 4 per cent. for the six months ended December 31st last.

The Hydro-Electric Securities Corporation is paying the usual half-yearly dividend on the 5 per cent. class "B" cumulative participating preferred shares.

Stocks and Shares

TUESDAY EVENING.

QUIET optimism is the keynote in most of the Stock Exchange markets. That there are several quite serious handicaps to progress is admitted, but the favourable factors outweigh these to an extent which warrants the investing of money freely in stocks and shares, particularly those which offer any opportunity of appreciation in price. People nowadays seem to be ignoring the immediate yield that they can obtain from the industrial shares, and to fix their attention more upon the possibility of dividend expansion, and consequent advance in capital value. Concurrently, there is a steady absorption of front-rank stocks, with the result that, owing to the scarcity of such securities, prices steadily mount.

Seldom a week passes without there being improvements in the prices of such purely gilt-edged issues as those quoted under our heading "Public Boards." This week, Central Electricity fives of 1950-70 have gained a point at 118. London Passenger Transport "A" is 2½ up; the "B" two points. Few of the stocks are obtainable in any but small amounts.

Transport "C"

The "C" stock of the London Passenger Transport Board is 2½ points up at 111½. This price compares with 77 at which the quotation opened when dealings first started in the stock, and goes against 91 as the lowest price last year. The rise is due to the expectation that the Board will be able to declare this year a higher dividend than the 4 per cent, distributed in respect of the preceding twelve months. It will be remembered that the maximum dividend which the "C" stock can claim out of earnings is 6 per cent., though such a rate is hardly likely to be available for some years to come. There is, however, the distinct possibility of 4½ or 5 per cent. being paid during the next year or two.

Some people consider that the current price of 111½ for Transport "C" stock is sufficiently high, and advocate the sale of the stock in order that the money may be utilised in the purchase of some other security. Southern preferred is a favourite alternative. The stock stands at a substantially lower level and may have greater scope for appreciation in capital value. As a matter of fact, the same argument was heard when the Transport "C" stock stood 5 to 10 points lower than it does now, so that whatever sales were made at that time, they had no effect in keeping down the price of Transport "C."

Traffic Expansion

To what extent there is still scope for expansion in traffic on the London omnibuses, tramways and tubes, is a point often discussed. Those accustomed to travelling in London are painfully acquainted with the congestion at rush hours now, yet the transport services are so rapid, and so well organised, that it would seem as if little further expansion could be undertaken. Consequently, for any material increase in London Passenger Transport profits, it is assumed that the Board must look to potential traffics in districts lying outside the immediate London area. This consideration is the indirect cause of the extraordinary rise which has taken place in the

deferred stock of the British Electric Traction Company, and which has brought about an advance within a year of 800 points in the price. The Transport Board is expected to take over, sooner or later, as many outlying undertakings as it can obtain. It will be seen that the position is one of unusual interest, more especially to holders of the Transport "C" stock, who hope to get a useful increase in dividend, and that before very long.

Electricity Supply Shares

The pervading investment demand makes its influence felt upon the prices of electricity supply shares. The time for the payment of dividends is approaching, and this may have something to do with the strengthening of demand that has lifted City of London, "Countys," London Electric and various others to the extent of 6d. or 1s. North Metropolitans are 2s. 6d. higher at 60s. Edmundsons ordinary are better at 44s. 6d. bid. The same tendency is noticeable in the list of Provincial shares. Midland Counties and several others show further improvements. Northamptons at 55s. have gained 3s. 9d. In the overseas group, Perak Electrics at 23s. 9d., Palestine "A" at 55s. 6d. and East African ordinary at 32s. 6d., have shared in the general upward movement.

Dividend Expectations

The dividend on London Associated Undertakings shares will be, according to general expectation, 7 per cent. for the year recently ended. For 1934, before the amalgamation of the various London undertakers, the Westminster and the St. James' Electric both paid 7½ per cent. It is thought that this may be paid on London Associated twelve months hence. The expectation is reflected in the comparatively high price of the shares. The latter can be regarded as a gilt-edged investment; good enough, in fact, for the employment of money realised by the sale of purely trustee securities, and likely to receive an increased return as time goes on. Associated Electrical Industries shares are thought likely to get 8 per cent. when the dividend is declared next March. Last year's dividend was 6 per cent., against 4 per cent. in the previous twelvemonth.

Manufacturing and Equipment

General Electrics have spurted to 76s., at which price the return to a buyer is 2½ guineas per cent. on the basis of the last-paid 10 per cent. dividend. But everyone looks, of course, for something more substantial. Electric Constructions jumped 5s. to 37s. 6d., upon circulation of a rumour that the directors had received, and refused, an offer of 40s. for the issue. Another big rise is 6s. 3d. in Edison Swan first preference, lifting the price to 33s. 9d. The last-recorded transaction officially notified in the Stock Exchange List is at 29s. 6d. on November 28th, 1935. This instance illustrates the nominal nature of some prices when demand comes upon a market where there is no supply of shares. Enfield Cables are 6s. 3d. up at 5½, in sympathy with the spurt in Enfield Rolling Mills. Telegraph Constructions have firmed up to 26s. 3d.

New Shares

Buyers have been paying 30s. and a little more for Enfield Rolling Mills old shares. At 29s. 6d., the price is 1s. 6d. higher, and the new shares, at 9s. 6d. premium, are 2s. 3d. up on the week. The new shares were offered at 20s. 6d. to proprietors of the old, and are now 10s. 6d. paid. Crompton Parkinson new "A" shares show a reaction and the old at 67s. 6d. have gone back half-a-crown. Mention was made last week of the argument that 70s. is a fairly high figure, in spite of the conviction that in a year hence the price will stand higher. Speculation, which was extremely lively in Cromptons two or three weeks ago, has subsided to a material extent. Apparently the speculative brigade is more interested for the time being in other share activities.

Cable and Wireless

Cable and Wireless preference, after running neck-and-neck with London Transport "C," has dropped behind in the race for public favour. The price, at 106, has scarcely moved for a fortnight. The "A" stock is 5s. higher at 29½. Globe Telegraph preference at 14¾ have put on ¼. American Telephone and Telegraph holds its gain at 160¼, and Internationals at 14½ have put on the fraction. New York is doing a good deal in shares in utility companies, but price fluctuations are very erratic.

Telephone Condensers touched 55s., to react a few pence. Telephone Manufacturing at 8s. 1½d. are slightly below their best. Baird Televisions are quiet these days, the preferred being 4s. 3d., the deferred 6s. 7½d., and the A shares 3⅞.

Miscellaneous Matters

British Electric Traction deferred is 55 up at 1655. On one day this week, the extremes were 1635 and 1675. Tillings have jumped to 82s. 6d. Iron, steel and allied shares responded in mild degree to the prospect of settlement in the coal trade. Rubber shares went better on an improvement in the price of the produce. Business in most issues connected with electricity and its branches is not at all bad. And when a Stock Exchange man admits as much as this—and most members will, nowadays—it may be taken for granted that things might, indeed, be worse.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Jan. 14	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3⅛	—	3 17 5
City of London	1	7½	7½	37/6	+6d.	4 0 0
Clyde Valley	1	7	8	46/-	—	3 9 7
County of London	1	10½	10½	56/6	+6d.	3 14 0
Edmundson's 7% Pref.	1	7	7	36/-	—	3 17 9
Do. Ord.	1	7	8	44/6	—	3 12 0
Elec. Dis. Yorkshire	1	9	9	47/-	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 7/16	—	3 12 9
Elec. Supply Corporation	1	11	11	3½	—	3 10 3
Lancs Light and Power	1	7½	7½	38/-	—	3 19 0
Lond. Assoc. Electric	1	—	—	36/-	—	3 17 9
London Electric	1	7	8	40/-	+6d.	4 0 0
London Power Deb. Red.	Stock	5	5	109½	—	4 11 4
Metropolitan	1	10	10	52/-	—	3 17 0
Midland Counties	1	7	7	40/6	+6d.	3 9 2
Mid. Elec. Power	1	8	8	41/3	—	3 17 6
North Eastern Electric Ordinary	1	6	6	34/-	+6d.	3 10 7
Do. 7% Pref.	1	7	7	35/6	—	3 19 0
Northampton	1	10	10	55/-	+ 3/16	3 12 9
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	3	+¼	3 6 8
Do. do. 6% Pref.	1	6	6	32/-	—	3 15 0
Scottish Power	1	8	8	43/3	+9d.	3 14 3
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/-	—	3 9 7
PUBLIC BOARDS.						
Central Electricity 1950–70	Stock	5	5	118	+1	4 4 9
Do. 1055–75	„	5	5	120	+¼	4 3 4
Do. 1951–73	„	4½	4½	111	—	4 1 1
Do. 1963–93	„	—	3½	106	—	3 6 0
London Elec. Trans. Gtd.	„	—	2½	97	—	2 11 8
London & Home Counties, 1955–75	„	4½	4½	112xd.	—	4 0 4
London Passenger Transport, A	„	—	4½	126½	+2½	3 11 2
Do. do. B	„	—	5	130½	+2	3 16 8
Do. do. C	„	3½	4	111½	+2½	3 11 9
West Midlands Joint Elec. 1948–68	„	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	160½	—	5 12 2
Anglo-Am. Tel. Pref.	Stock	6	6	124½	—	4 16 5
Do. Def.	„	1½	1½	31	—	4 16 10
Cable & Wireless 5½% Pref.	„	2¾	4½	106	—	3 17 10
Do. A. 7½% Ord.	„	Nil	Nil	29¾	+¼	—
Do. B. Ord.	„	Nil	Nil	8	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	15½	—	2 6 0
Do. do. Pref.	10	6	6	14¾	+¼	4 3 6
Great Northern Tel.	10	20	20	40	—	5 0 0
Marconi-Marine	1	10	7½	36/3	—	4 2 9
Oriental Telephone Ord.	1	12	12	3½	—	*3 16 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	1655	+55	—
Do. do. Pref. Ord.	„	8	8	173½	—	4 12 3
Brazil Traction	100	—	—	10	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	100½xd.	—	4 19 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	3	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	3½	—	—
West Riding	1	5	6½	52/6	+5/-	2 9 6
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	55/-	—	5 9 0
Assoc. Elec. Ord.	1	4	6	44/-	—	2 14 7
Do. Pref.	1	8	8	39/-	—	4 2 1
Babcock & Wilcox	1	6	8	53/-	—	3 0 6
British Aluminium Ord.	1	5	7½	43/9	—	3 8 6
British Insulated Ord.	1	5	15	5	—	3 0 0
Brush Ord.	Stock	Nil	Nil	40½	−1	—
Callender's	1	15	15	3⅞	—	3 17 5
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/-	—	12½	67/6	−½	0 10 0
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	33/9	+ 3/16	4 9 0
Electric Construction	1	Nil	3½	37/6	+5/-	1 17 4
Enfield Cable Ord.	1	25	25	5 13/16	+ 3/16	4 6 2
English Electric	1	Nil	Nil	22/-	−9d.	—
Do. do. Pref.	1	Nil	Nil	24/6	—	—
Ericssons Tel.	5/-	—	24	36/3	—	—
Ever Ready	5/-	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	27/-xd.	−3d.	5 3 8
G.E.C. Pref.	1	6½	6½	33/6	+6d.	3 17 7
Do. Ord.	1	8	10	76/-	+1/6	2 12 8
Henlys	1	30	30	7 1/16	—	4 5 0
Do. 4½% Pref.	5	4½	4½	5⅞	—	3 16 8
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	48/9	−9d.	3 1 6
Siemens Ord.	1	6½	4	26/3	—	3 1 0
Telegraph Construction	£1	Nil	Nil	26/3	+1/6	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

11980. "Electric discharge tubes." O. S. Duffendack and R. A. Wolfe. May 1st, 1933. (Cognate application 11981-34.) (440100.)

13702. "Electric switches." Walsall Conduits, Ltd., and F. C. Raphaels. May 7th, 1934. (439877.)

14306. "Ionic amplifiers or detector tubes." S. Ruben. December 16th, 1933. (439879.)

17211. "Electric lampholders and adaptors." O. C. Jones. June 11th, 1934. (439949.)

17263. "Means of controlling, hoisting, and lowering overrun switches, or limit switches of electrically or power-driven cranes." S. Holdway. June 11th, 1934. (439950.)

17400. "Speed-control of alternating current motors." British Thomson-Houston Co., Ltd., B. Adkins and H. W. C. Liddiard. June 12th, 1934. (440028.)

17493. "Clockwork driven apparatus for electrically driven switches." J. R. W. Gunning. June 13th, 1934. (439953.)

17514. "Synchronous electric motors." British Thomson-Houston Co., Ltd. June 13th, 1933. (439893.)

17521. "Automatic voltage-regulation of electric generators." J. Stone & Co., Ltd., and L. R. Nixon. June 13th, 1934. (Cognate application 12696/35.) (439955.)

17621. "Brush-holders for dynamo electric machines." W. S. Graff-Baker, and the London Passenger Transport Board. June 14th, 1934. (440030.)

17649. "Gas- or vapour-filled electric-discharge apparatus." Siemens Schuckertwerke, Akt.-Ges. June 14th, 1933. (Cognate applications 17650/34, 17651/34, and 17653/34.) (440031.)

17652. "Gas- or vapour-filled electric-discharge apparatus." Siemens Schuckertwerke, Akt.-Ges. August 15th, 1933. (439957.)

18006. "Choke coils for electric circuits." British Thomson-Houston Co., Ltd., and H. S. Holbrook. June 18th, 1934. (439964.)

18048. "Combined telegraph and telephone-exchange systems." Standard Telephones & Cables, Ltd., and B. B. Jacobsen. June 18th, 1934. (439970.)

18049. "Electric remote indicating systems." Standard Telephones & Cables, Ltd., J. B. Griffiths, A. Brown, A. M. Searle and G. A. M. Hyde. June 18th, 1934. (439971.)

18097. "Permanent magnets." J. Lucas, Ltd., and E. A. Watson. June 19th, 1934. (440038.)

18158. "Electrically heated cooking vessels and liquid-containing utensils." H. N. Shaw. July 1st, 1933. (440105.)

18180. "Electric communication systems." A. T. Starr, and Baird Television, Ltd. June 19th, 1934. (439977.)

18184. "Loudspeakers and the like." R. R. Glen. June 19th, 1934. (440041.)

18204. "Braun tube for producing television images of large size." Radio Akt.-Ges. D. S. Loewe. June 27th, 1933. (440106.)

18437. "Electric cables." Callender's Cable & Construction Co., Ltd., and D. M. Robinson. June 22nd, 1934. (439980.)

19289. "Apparatus for the control, dependent upon load, of the speed of an electromotor supplied through grid-controlled current-rectifiers. Siemens-Schukertwerke, Akt.-Ges. September 27th, 1933. (439896.)

19470. "Control electrodes for low-pressure electric arc convertors." General Electric Co., Ltd., and E. Gallizia. July 2nd, 1934. (440120.)

19643. "Electric couplings of the plug-and-socket type." J. A. Crabtree. July 4th, 1934. (Addition to 421892.) (439897.)

20275. "Electric-arc welding." F. B. Dehn (R. W. Carter and Hume Steel, Ltd.). July 10th, 1934. (439900.)

20579. "Electric plug coupling for radio and other purposes." R. W. Bonson. July 12th, 1935. (440121.)

22575. "Gas-filled cathode-ray tube arrangements suitable for use in television reception." Telefunken Ges. für Drahtlose Telegraphie. August 2nd, 1933. (439990.)

23173. "Electric transformers." British Thomson-Houston Co., Ltd. August 11th, 1933. (439901.)

23753. "Alternating-current electric motors." General Electric Co., Ltd., and J. R. Henderson. August 17th, 1934. (439992.)

23780. "Remote-control of railway-track switches and signals." General Railway Signal Co. September 12th, 1933. (440048.)

24400. "Television, telekinematographic, or like systems, and apparatus therefore." T. E. Bray, and Baird Television, Ltd. August 24th, 1934. (439994.)

26197. "Electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand Ges. für Elektrische Glühlampen). September 12th, 1934. (Cognate application 26807/34.) (439995.)

26289. "Electric power factor measuring instruments." General Electrical Co., Ltd., H. C. Turner, and A. Sherwin. September 13th, 1934. (439996.)

26578. "High-tension proof röntgen tube." Radiologie, Akt.-Ges. September 15th, 1933. (439904.)

26918. "Indicating apparatus for use in tuning radio-receiving apparatus. G. B. Kemp. September 19th, 1934. (439905.)

30277. "Variable electric condensers." A. C. Cossor, Ltd., and D. G. Rennett. October 22nd, 1934. (440137.)

31143. "Electric-discharge vessels." General Electric Co., Ltd., and P. Middleton. October 30th, 1934. (440138.)

32009. "Cathode-ray oscillographs." General Electric Co., Ltd., D. H. Donaldson and N. C. Smart. November 7th, 1934. (440053.)

34052. "Rolling mills with direct individual driving of the rolls by electric motors." Schloemann, Akt.-Ges., and H. Nehlsen. November 27th, 1934. (439913.)

35472. "Track brake magnets." Knorr-Bremse, Akt.-Ges. September 1st, 1934. (439915.)

35809. "High frequency signalling over cables.' C. Lorenz, Akt.-Ges. December 16th, 1933. (440143.)

36721. "Electric storage batteries." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 14th, 1934. (439917.)

36869. "Impulse transmitters for electric remote-control systems." Landis & Gyr, Akt.-Ges. January 13th, 1934. (440063.)

37353. "Electric tumbler switches." A. P. Lundberg & Sons, Ltd., and G. Pegg. December 31st, 1934. (440065.)

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749. "Thermionic valves." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. January 9th, 1934. (Cognate application 750/35.) (440146.)

7186. "Insulating joints for electric cables." Norddeutsche Seekabelwerke, Akt.-Ges. February 4th, 1935. (440076.)

10066. "Clamp device for laminar cores for electrical apparatus." J. Flieder. April 1st, 1935. (440008.)

10254. "Method of and means for electrical grilling." W. H. Myers. May 11th, 1934. (440153.)

11758. "Method of sealing conductors into glass envelopes for radio tubes, incandescent lamps, and the like." British Thomson-Houston Co., Ltd. April 19th, 1934. (439927.)

14000. "Electrical choking coils having laminated iron cores." Landis & Gyr, Akt.-Ges. May 29th, 1934. (440085.)

14959. "Electrodes for electric welding." G. Block and E. Schroder. August 21st, 1934. (440017.)

15215. "Cathode ray tubes." Fernseh, Akt.-Ges. May 24th, 1934. (440087.)

15408. "Metal vapour ionic valves." Allmänna Svenska Elektriska Aktiebolaget. May 28th, 1934. (440158.)

15860. "Electrical cooking apparatus." A. Walterspiel. May 31st, 1935. (440088.)

16405. "Electrical connectors." R. E. Farish, jun. June 5th, 1935. (439934.)

16621. "Band filters constituted by capacitatively coupled circuits." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 13th, 1934. (440091.)

17737. "Control systems for electromagnets." British Thomson-Houston Co., Ltd. June 21st, 1934. (440161.)

18567. "Regenerative repeaters for telegraph signals." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). June 28th, 1935. (440092.)

18585. "Thermal switches." British Thomson-Houston Co., Ltd. June 29th, 1934. (440093.)

21114. "Switch devices for kinematograph apparatus." R. Bosch, Akt.-Ges. July 25th, 1934. (439938.)

21386. "Electron emitters for electron-discharge devices." Standard Telephones & Cables, Ltd. September 5th, 1934. (440094.)

24308. "Electric welding apparatus." British Thomson-Houston Co., Ltd. August 30th, 1934. (440021.)

28126. "Photo cells." Süddeutsche Apparate-Fabrik Ges. October 17th, 1934. (439942.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections agaipst any of the proposed marks may be entered within one month from January 8th:—

Tireless Tim. No. 564982. Class 6. Vacuum cleaning machines.—Hogan and Wardrop, Ltd., 25, Old Street, E.C.1.

Philco. No. 564864. All goods in Class 8.—Philco Radio and Television Corporation of Great Britain, Perivale, Greenford, Middlesex.

Electronic Tornado. No. 557829. Class 18. Electric arc welding plant.—Lincoln Electric Co., Cleveland, O., U.S.A. (British representatives: Stevens, Langner, Parry and Rollinson, 5-9, Quality Court, Chancery Lane, W.C.2.)

Training Engineers in India

In the course of an address recently delivered at the Royal College of Science in Bombay Mr. S. E. Povey, chairman of the Local Committee of the Institution of Electrical Engineers, is reported to have said that there was plenty of good material in India to fill the ranks of electrical engineers. But for students and apprentices adequately to hold such positions they had to be suitably instructed, guided and assisted. He deprecated the prevailing tendency to criticise the budding engineer and his work, and suggested that the foreman or employer of the apprentice or student should be patient and tolerant; he should seek to understand the ideas of the student and then guide and lead him along the right path. Such a method of instruction created mutual understanding, whereas the methods of teaching employed in the majority of colleges only strove for good examination results. Mr. Povey stated that a higher standard should be sought and engineering degrees should only be accorded to those best fitted to go out into the world worthily to fill that job. Mr. Povey criticised university authorities who had joined together the two departments of engineering—mechanical and electrical—in the graduation course, saving that they were entirely different branches requiring different types of men. The speaker also referred to the system of training by premiums and practical training and asserted that men who had gone through all branches of their craft were generally recognised as the best practical engineers.